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Includes aeronautics (general); aerodynamics; air transportation and safety; aircraft communications and navigation; aircraft design, testing and performance; aircraft instrumentation; aircraft propulsion and power; aircraft stability and control; and research and support facilities (air).

For related information see also *Astronautics*.

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For related information see also *34 Fluid Mechanics and Heat Transfer*.

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For related information see also *34 Fluid Mechanics and Heat Transfer*.

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Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

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20 SPACECRAFT PROPULSION AND POWER 2642

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For related information see also *07 Aircraft Propulsion and Power, 28 Propellants and Fuels,* and *44 Energy Production and Conversion*.

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Includes engineering (general); communications; electronics and electrical engineering; fluid mechanics and heat transfer; instrumentation and photography; lasers and masers; mechanical engineering; quality assurance and reliability; and structural mechanics.

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Includes information storage and retrieval technology; micrography; and library science.
For computer documentation see *61 Computer Programming and Software.*

83 ECONOMICS AND COST ANALYSIS 2754
Includes cost effectiveness studies.

84 LAW AND POLITICAL SCIENCE 2754
Includes space law; international law; international cooperation; and patent policy.

85 URBAN TECHNOLOGY AND TRANSPORTATION 2754
Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.
For related information see *03 Air Transportation and Safety, 16 Space Transportation,* and *44 Energy Production and Conversion.*

SPACE SCIENCES

Includes space sciences (general); astronomy; astrophysics; lunar and planetary exploration; solar physics; and space radiation.
For related information see also *Geosciences.*

88 SPACE SCIENCES (GENERAL) N.A.

89 ASTRONOMY 2757
Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

90 ASTROPHYSICS N.A.
Includes cosmology; and interstellar and interplanetary gases and dust.

91 LUNAR AND PLANETARY EXPLORATION 2758
Includes planetology; and manned and unmanned flights.
For spacecraft design see *18 Spacecraft Design, Testing and Performance.* For space stations see *15 Launch Vehicles and Space Vehicles.*

92 SOLAR PHYSICS 2758
Includes solar activity, solar flares, solar radiation and sunspots.

93 SPACE RADIATION 2758
Includes cosmic radiation; and inner and outer earth's radiation belts.
For biological effects of radiation see *52 Aerospace Medicine.* For theory see *73 Nuclear and High-Energy Physics.*

GENERAL

99 GENERAL 2759

Note: N.A. means that no abstracts were assigned to this category for this issue.

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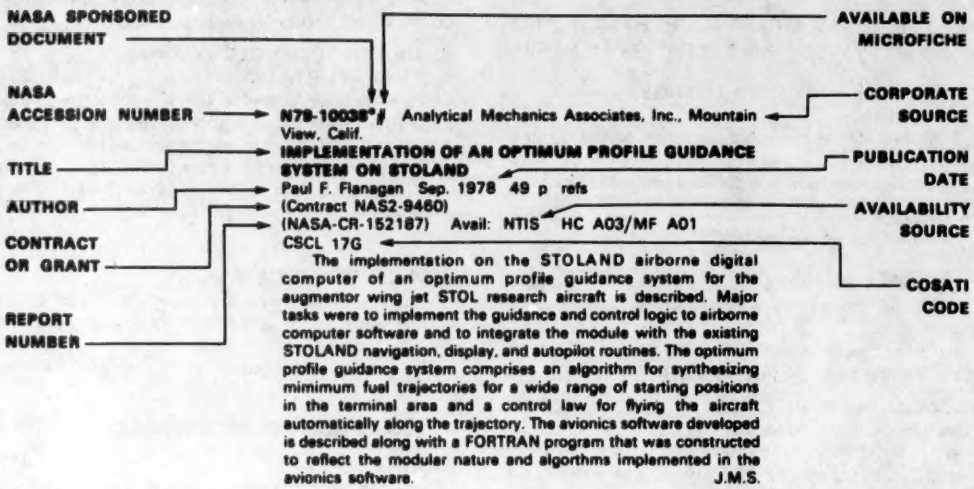
TYPICAL CITATION AND ABSTRACT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Analytical Mechanics Associates, Inc., Mountain View, Calif.
CORPORATE SOURCE
TITLE
IMPLEMENTATION OF AN OPTIMUM PROFILE GUIDANCE SYSTEM ON STOLAND
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Paul F. Flanagan Sep. 1978 49 p refs
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The implementation on the STOLAND airborne digital computer of an optimum profile guidance system for the augmentor wing jet STOL research aircraft is described. Major tasks were to implement the guidance and control logic to airborne computer software and to integrate the module with the existing STOLAND navigation, display, and autopilot routines. The optimum profile guidance system comprises an algorithm for synthesizing mimimum fuel trajectories for a wide range of starting positions in the terminal area and a control law for flying the aircraft automatically along the trajectory. The avionics software developed is described along with a FORTRAN program that was constructed to reflect the modular nature and algorithms implemented in the avionics software.
J.M.S.

ON-GOING RESEARCH PROJECTS

This is a listing of research projects - not publications

AERONAUTICS

Includes Aeronautics (general); Aerodynamics; Air Transportation and Safety; Aircraft Communications and Navigation; Aircraft Design, Testing, and Performance; Aircraft Instrumentation; Aircraft Propulsion and Power; Aircraft Stability and Control; and Research and Support Facilities (air). For Related Information See Also Astronautics.

1.0001, 270VDC AVIONIC POWER SUPPLY IMPACT STUDY

W. Cloud, Lockheed Aircraft Corp., *2555 N. Hollywood Way, P.O. Box 551, Burbank, California* 91503 (DN881390; N62269-78-C-0007)

To investigate the impact on avionic equipment power supplies when redesigned to perform from the 270vdc power system versus the present ac 400 hz power system. This contract supports work unit ZA601, Agency Accession No. DN681080.

To perform a detailed design analysis of the avionic equipment power supplies on the S3A aircraft to assess the impact of designing for performance from the 270vdc power system.

SUPPORTED BY U.S. Dept. of Defense, Naval Air Development Center, Aircraft & Crew Systems Tech Directorate

1.0002, SENSITIVITY OF OPTIMIZED STRUCTURES

B.O. Almroth, Lockheed Aircraft Corp., *3251 Hanover St., Palo Alto, California* 94304 (DF136890; F33615-76-C-3105)

Stability of structural components is one of the most important considerations in airframe design. It is known that the structural components which are critical in buckling are sensitive to initial geometric deviations. The presence of initial deviations reduces the buckling load of the structures. In the case of optimized structures the effect of the initial imperfection is seriously enhanced. The purpose of this effort is to develop a method to study this effect.

A finite element or other numerical method will be used to study the response of optimized structures with initial geometric deviations. Different structural configurations will be investigated to determine the sensitivity of each configuration.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0003, HYBRID COMPUTER ERRORS IN ENGINEERING FLIGHT SIMULATION

R. Weeks, Northrop Corp., *3901 W. Broadway, Hawthorne, California* 90250 (DF141510; F33615-78-C-3608)

The mission of this work unit is to support research and development into engineering manned flight simulation. Errors in simulations are ever present and the objective of this work unit is to define these errors and determine their impact on long duration simulations. With this information simulations will be designed so as to minimize these errors thereby making simulations more realistic to the pilots. The more realistic a simulation is the more confidence may be attached to problem solving using simulations.

The approach will be to consider three computer configurations, pure analog, pure digital and hybrid computers, consider the different sources of errors that might be present, consider a sample problem which will be used to analyze these errors and then consider the accumulation of errors for a long period simulation.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0004, SONIC FATIGUE DESIGN TECHNIQUES FOR ADVANCED COMPOSITE AIRCRAFT STRUCTURES

I.F. Holehouse, Rohr Corp., *Chula Vista, California* (DF139810; F33615-77-C-3033)

Past composite panel designs for application in a high-intensity noise environment have followed closely the designs used for metal structures. Some of the advantages of composite materials such as tailorability have not been fully exploited to provide optimum structural design. The objective of this program is to develop the techniques for designing advanced composite panels and substructures for minimum dynamic stress response and maximum fatigue life when exposed to high-intensity noise loading.

The approach is to conduct analytical and experimental investigations using the tailorability of advanced composite construction to minimize the stress response and maximize fatigue life under acoustic excitation by optimizing the number of plys, orientation of plies, the type of matrix material, joint design, stiffener design and configuration.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0005, MANNED, ENGINEERING FLIGHT SIMULATION VALIDATION

L.G. Hoffman, Systems Technology Inc., *13766 S. Hawthorne Blvd., Hawthorne, California* 90250 (DF140180; F33615-77-C-2065)

This work unit supports research and development into enginneering manned flight simulation. The technology areas to be addressed are simulation fidelity requirements, simulator fidelity requirements, and simulator systems fidelity. Simulation fidelity requirements will define the system quantities, including response and behavior characteristics of pilot test subjects, which must be correlated with actual flight in order to satisfy experiment objectives. Simulator requirements will define those characteristics of simulated flight necessary to attain the desired simulation fidelity. Simulator systems fidelity will evaluate the potential to satisfy simulator fidelity requirements of the simulator hardware and software located at the flight control development laboratory. The objective of this work unit is to develop the technology to perform confident extrapolation of meaningful manned engineering flight simulation results to the real world environment. The development and application of these technologies will contribute to effective utilization of existing simulator hardware and software, and impact future simulator design.

Methods will be developed to specify simulation and simulator requirements. These methods will be applied to an analysis of terminal air-to-air combat simulation. Methods will be developed to evaluate simulator systems. These methods will be applied to an evaluation of the capacity of the lamars motion drive system to perform terminal air-to-air combat simulation.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab

1.0006, RPV (REMOTELY PILOTED VEHICLE) ADVANCED LAUNCHER SYSTEM

B. Kurz, Teledyne Inc., Teledyne Ryan Aeronautical Div, *7155 Mission Gorge Rd., San Diego, California* 92120 (DA0E3779; DAAJ02-77-C-0048)

To perform an evaluation and selection of RPV launcher systems compatible with US Army operations and environmental factors.

To seek, search out, and document available launch techniques and provide rating factors pertinent to Army missions.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Air Mobility Research & Development Lab.

1.0007, EVALUATION OF LIME TREATED NATIVE SOIL FOR BASE COURSES AT AIRPORTS USED BY LIGHT AIRCRAFT

Unknown, U.S. Dept. of Defense, Navy, Civil Engineering Lab., *Port Hueneme, California* 93043 (FA78WAI-834; FA161213 (TRAIS NO.))

The objective of this study is develop criteria for the use of lime stabilization of subgrade material to serve as base course for light-duty airport pavements.

SUPPORTED BY U.S. Dept. of Transportation, Federal Aviation Admin.

1.0008, AIRCRAFT COCKPIT INFORMATION PROCESSING AND DISPLAY

D. Cohen, University of Southern California, Information Sciences Inst., *Marina Del Rey, California* 90291 (DN775186; N00014-78-C-0189)

This task, concerned with introducing advanced computing power and display techniques into the cockpits of high-performance naval aircraft, has the ultimate objectives of effecting improvements in the way aircraft are handled, while increasing safety and efficiency and reducing pilot training costs. The goal is that of capitalizing on newly developed graphics display and miniaturized computational power to greatly reduce the routine effort of flying and to assist pilots in such important task areas as energy management and crisis recognition and management.

Contractor will review the literature on the state of the art in the relevant domains. He will communicate with Navy and Air Force, NASA, FAA, and commercial airline personnel on the requirements for cockpit computation and display. Contractor will evaluate relevancy of recent technological developments to the cockpit problem, e.g., graphics, LSI techniques, portable large memory units. In parallel with the above, contractor will design experimental concepts and tools appropriate to assessing effectiveness of advanced concepts in the cockpit situation.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

1.0009, HELICOPTER RECOVERY SYSTEMS FOR ASW STORES

J.H. Camisa, U.S. Dept. of Defense, Navy, Naval Air Systems Command, *Washington, District of Columbia* 20361 (DN589517)

Develop and evaluate experimental ASW stores helicopter launch, handling and recovery systems and equipment for potential use in land-based and open ocean exercises. Of particular importance at this time are: A. Investigation development of an experimental shock mitigation device and failure indicating cables to improve rescue hoist/recovery equipment compatibility. B. Development of an experimental stowable skirt recovery system for a wide range of ASW stores. C. Development of an experimental fixed skirt recovery system for range with torpedoes MK44/MK46.

A. Investigate the helicopter rescue hoist/recovery equipment interface for acceleration and loading characteristics. Develop and evaluate experimental shock mitigating devices to decrease shock loadings experienced during hoist operations. Investigate hoist cable constructions to develop an experimental cable with an integral failure indicating weak link. B. Incorporate stowing concepts into fixed skirt model configuration. Flight test completed experimental model for flight envelopes, stowage, deployment and recovery. C. Expand fixed skirt concepts to build an experimental range use cage for torpedoes MK44 and MK46.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

1.0010, DEVELOPMENT OF A STOCHASTIC THEORY OF ROTOR BLADE DYNAMICS 15193-E

Y.K. Lin, University of Illinois, Urbana Champaign Campus, School of Engineering, Dept. of Aeronautical & Astronaut Engin, *2527 Hydrosystems Lab., Urbana, Illinois* 61801 (DA0F9151; DAAG29-78-G-0039)

To develop a comprehensive stochastic theory of rotor blade dynamics capable of predicting instability in the presence of atmospheric turbulence. Relevance - results from this research could be significant for the understanding and eventual design improvements of the Army helicopter rotors.

The standard equations of motion are generalized to include the effects of turbulence. Stability is defined in terms of stochastic convergence and the stochastic differential equations are solved using the method of Stratonovich. A limited experimental program will be carried out to provide data for comparison with the theoretical results.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

1.0011, SUPPORT SERVICES FOR TECHNICAL PROGRAMS WITHIN RESEARCH AND TECHNOLOGY GROUP

M. Scalzo, O A O Corp., *5050 Powder Mill Rd., Beltsville, Maryland* 20705 (DN890118; N00019-78-C-0353)

To obtain engineering analysis, supporting data and associated technical writing in support of the research and technology within the the areas of naval aviation.

The contractor will analyze and evaluate elements that are critical to the technical programs within the research and technology group.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

1.0012, HELICOPTER ROTOR NOISE STUDIES 12931-EX

W.L. Harris, Massachusetts Inst. of Technology, School of Engineering, Dept. of Aeronautics & Astronautics, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (DA0E9066; DAAG29 76 C 0027)

To conduct experiments to identify and quantify the mechanisms of rotor noise generation at low subsonic tip Mach number, to obtain the characteristics of the resulting acoustic field and to evaluate and varify experimentally a Mach number scaling formula for rotational noise at low tip speeds. This research is directly relevant and contributory to the research investigations on helicopter rotor noise at both the Langley and Ames Directorates of AMRDL. The proposed investigations cover a flight regime for which there are no facilities at AMRDL and would, therefore, be highly useful in any comprehensive helicopter noise reduction program.

A unique experimental facility consisting of an open jet test section in an anechoic room will be utilized to determine the effects of blade number, advance ratio, thrust and rotor disk tilt angle on rotational noise and blade slap.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

1.0013, RIGID AIRFIELD PAVEMENT LOAD-DEFORMATION RESPONSE ANALYSIS

Y.T. Chou, U.S. Dept. of Defense, Army, Corps of Engineers, Waterways Experiment Station, *P.O. Box 631, Vicksburg, Mississippi* 39180 (DA0L8184)

To evaluate and select or develop appropriate mathematical expressions (models) that will accurately predict the response of total pavement systems when subjected to various loading inputs

based upon the thickness and quality of materials comprising the pavement system. The predictive response model or models are essential to the development of improved pavement criteria which will consider the life cycle of the pavement system.

Several mathematical models have been developed for predicting pavement response. From these available models, one will be selected, modified as necessary, and validated for use by means of available full-scale test data and performance data from actual airfields. Of concern will be development of methods to analyze joints, cracks, and other discontinuities in rigid pavements. The basic components for a finite element analysis will be assembled for modeling discontinuous composite (soil, concrete, steel) systems. Joint elements, interface elements, linkage elements (steel and concrete), and normal elements will be assembled in a code designed specifically for analyzing rigid pavements.

SUPPORTED BY U.S. Dept. of Defense, Corps of Engineers, Waterways Experiment Station

1.0014, MULTIFUNCTION INERTIAL REFERENCE ASSEMBLY FOR AIRCRAFT

R. Burns, McDonnell Douglas Astronautics Co., *E. 411 St., St. Louis, Missouri* 63166 (DF138260; F33615-76-C-3132)

The Air Force function for the multifunction inertial reference assembly (MIRA) is to provide inertial reference and air data information for all flight control, navigation, weapons delivery, and terminal area functional requirements. This work supports advanced fighter and military transport aircraft. The problem is that present aircraft inertial reference and air data systems are costly to procure and maintain. The objective of this effort is to establish architecture and system interfaces for a modular, redundant multifunction inertial reference assembly (MIRA). Establish life cycle cost savings. Implementation of the MIRA approach would result in replacement of numerous and costly rate gyros, accelerometers, inertial platforms, vertical and directional gyros, lead computing gyros and compass systems. Life cycle cost savings approaching 50 percent are anticipated.

This investigation will first establish functional and performance requirements for MIRA based upon mission scenario of an air superiority fighter and a medium STOL transport using computer analysis. Error budgets will be derived and reliability, safety, and survivability requirements will be defined for the missions. Next, candidate inertial and air data sensing and processing technologies will be established, considering redundancy and multiplex bus requirements, these will be analyzed in detail. Detailed preliminary mechanical and electronic designs will be accomplished. Life cycle cost and trade analyses will be conducted and system selected for MIRA concept demonstration. Test plans will be developed.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0015, SALT WEATHERING OF PAVEMENTS

J. Sayward, U.S. Dept. of Defense, Army, Corps of Engineers, Cold Regions Research & Engineering Lab., *P.O. Box 282, Hanover, New Hampshire* 03755 (DA0F8140)

Establish the mechanism whereby pavements undergo serious deterioration due to the use of de-icing chemicals in winter. A better understanding of this mechanism may lead to substantial reduction in the rehabilitation costs for pavements at northern military facilities and airfields.

Approximately 40 carefully prepared concrete samples will be tested in 10 different solutions under an array of air nozzles.

SUPPORTED BY U.S. Dept. of Defense, Corps of Engineers, Cold Regions Research & Engineering Lab.

1.0016, ADVANCED AVIATION ENGINEERING AND ANALYSIS INVESTIGATIONS

G. Chernowitz, American Power Jet Co., *705 Grand Ave., Ridgefield, New Jersey* 07657 (DN890067; N00019-78-C-0073)

Analysis of advanced aviation system concept areas relating to advanced aircraft and weapons systems, support alternatives, cost and effectiveness.

Technical alternatives substantially enhancing naval aviation capability are subjects of individual studies. Each report deals with a major subject area and includes conclusions and recommendations substantiated by the results of quantitative analysis. Techniques include engineering feasibility, system effectiveness and cost assessment and field observation.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

1.0017, AIRBORNE VELOCITY SENSOR TECHNOLOGY

R. Day, Singer Co., Kearfott Division, *1150 McBride Ave., Little Falls, New Jersey* 07424 (DN781337; N62269-76-C-0471)

The objective of this task is to develop a full-function correlation velocity sensor. This work supports work unit ZC801, Agency Accession No. DN 781336.

A development model velocity sensor will be built to measure two dimensions of horizontal velocity, including hover, by the correlation technique. The sensor will be designed to operate over all terrains and water surface conditions.

SUPPORTED BY U.S. Dept. of Defense, Naval Air Development Center, Communication Navigation Tech Directorate

1.0018, VISUAL LANDING AIDS (VLA) SIMULATION

R. Ferraglio, U.S. Dept. of Defense, Navy, Naval Air Engineering Center, *Lakehurst, New Jersey* 08733 (DN796000)

To be able to simulate all platforms/planes, vla configurations, and make recommendations on improvements of existing and new configurations.

There are several government facilities as well as private industry that have highly sophisticated simulation facilities and with slight modification can aid the testing of VLA equipment for all types of platforms and planes.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

1.0019, THREE-DAY SYMPOSIUM ON AERONAUTICS AND SPACE

R.S. Sanchez, University of New Mexico, Graduate School, *University Hill N.E., Albuquerque, New Mexico* 87106 (NASW 3243)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

1.0020, DEVELOPMENT OF AIRCRAFT DEPARTURE CRITERIA

W. Bihrle, Bihrle Applied Research Inc., *400 Jericho Tpke., Jericho, New York* 11753 (DN881164; N62269-77-C-0106)

To develop selected aircraft departure criteria and associated design charts and to demonstrate correlation with existing aircraft. This contract supports work unit ZA601, 'Aircraft Technology,' Agency Accession Number DN681080.

Differing models of CNA, CN, CL (as functions of A, B, and GE) and mass distribution will be applied to 6 D.O.F. equations to determine departure susceptibility. Design charts will be constructed depicting departure--stable and unstable conditions.

SUPPORTED BY U.S. Dept. of Defense, Naval Air Development Center, Aircraft & Crew Systems Tech Directorate

1.0021, DEMONSTRATION OF DIVERGENCE AND FLUTTER PREVENTION FOR FORWARD SWEPT WINGS

K. Wilkinson, Grumman Corp., *S. Oyster Bay Rd., Bethpage, New York* 11714 (DF142350; F33615-78-C-3223)

Recent feasibility studies indicate that aircraft with forward swept wings show significant improvements in transonic performance when compared to conventional aircraft. Sweeping conventional metal wings forward decreases aeroelastic divergence speed but by using advanced composite materials and incorporating bending-twist coupling in the design, forward swept

wings can be divergence and flutter free. The objective of this program is to provide correlation between analytical estimates of flutter and divergence speed and wind tunnel tests. The results of this program will be applied to the design and testing of high-performance aircraft with swept forward wings.

The program consists of four phases. Phase 1 is the design and analysis of scaled models demonstrating prevention of aeroelastic divergence and flutter of forward swept wings. The model will be representative of a flight demonstrator using advanced composite materials. Phase 2 is fabrication of the wind tunnel models. Phase 3 is model testing and data reduction. Phase 4 is correlation of analysis and test results.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0022, INVESTIGATION TO VALIDATE A METHOD OF NONDESTRUCTIVE EVALUATION OF CIVIL AIRPORT PAVEMENTS

Unknown, Yang Stevens Fabian Engineers, *New York, New York* 10017 (FA77WA-3964; FA160049 (TRAIS NO.))

The purpose of the program is to determine the thicknesses and physical characteristics of the pavement layers. The program shall be comprehensive enough to provide representative samples complete with typical values and statistical parameters and shall include classification of soils, moisture-density values, and elastic modulus properties of granular paving materials and subgrade soils to a depth of 10 feet below the pavement surface. Dynamic strength and stiffness values for bound paving materials shall also be determined.

SUPPORTED BY U.S. Dept. of Transportation, Federal Aviation Admin.

1.0023, HYPERMIXING NOZZLE

Unknown, Rockwell International Corp., Aircraft Div, *4300 E. 5th Ave., Columbus, Ohio* 43216 (DN890027; N00019-77-C-0527)

Design and evaluation of an improved hypermixing nozzle.

Using an existing turbulence kinetic energy computer program the entrainment characteristics of various nozzle configurations will be compared. The nozzle configuration exhibiting the most desirable characteristics will be defined relevant to the arrangement of hypermixing and inside elements. Based on these results a hypermixing nozzle will be designed and experimentally tested.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

1.0024, FEASIBILITY OF MONITORING THE ACCUMULATION OF FATIGUE DAMAGE ON CRITICAL STRUCTURAL COMPONENTS OF OPERATIONAL FLEET HELICOPTERS

G.E. Brazier, Technology Inc., *7400 Colonel Glenn Hwy., Dayton, Ohio* 45431 (DN790048; N00019-77-C-0318)

The acceptable system defined in this proposed study will satisfy the three objectives related to fatigue components during the service lifetime of a helicopter fleet; that is, the continuing assessment of service reliability, the rational adjustment of inspection and maintenace requirements, and the improvement of design criteria for future helicopters.

The contractor will investigate the requirements of the Navy RH-53D program for a structural integrity recording system (SIRS), define the flight condition monitoring concept for the RH-53D application, define SIRS for the RH-53D application, determine its cost effectiveness, and a pilot program to demonstrate it on a selected sample of helicopters performing normal missions.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

1.0025, FEASIBILITY OF INCREASED SIMULATION CAPABILITY THROUGH IMPROVED SIMULATION HARDWARE PERFORMANCE

R.S. Simmerman, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF132890)

This effort is in support of the R&D flight simulator mission of the Air Force Flight Dynamics Laboratory. This work is an opportunity to improve the adequacy and quality of derived data. Yet, improved maintainability and reliability will result as a byproduct. The objective of this effort is to increase the simulation capability of the existing facility by improving the performance of simulation hardware. This work contributes to the accuracy and validity of simulation research programs. Additionally, it increases the capability and flexibility of simulation hardware.

Feasibility studies will be conducted to determine the effectiveness and desirability of equipment modifications which will improve their performance. Examples are visual system angular deflections and rate limitations, motion system travel and rate limitations, cockpit control feel systems and location and type of flight instruments. Limited experiments may be conducted to validate improvement required, recommend equipment modifications, and acquire pertinent hardware.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0026, LANDING SYSTEM RELIABILITY AND SAFETY MODEL

L.S. Gephart, University of Dayton, School of Business Admin., Dept. of Management Science, *300 College Park Ave., Dayton, Ohio* 45469 (DF134760; F33615-74-C-3075)

No standard for evaluating the reliability and safety of a proposed all-weather landing system (AWLS) configuration exists within the military or civilian agencies. The objective is to develop a model which can provide a detailed analysis of reliability/safety of the total landing system. All configurations for both primary and back-up operations will be analyzed to enhance the safety of category III weather flight test. The back-up modes will include human capability augmented with back-up hardware configurations. Studies using the model should be able to provide insight on obtaining the highest probability that the aircraft tests will be conducted safely in all-weather landings.

The approach will be to develop a reliability/safety model of the C-141/James M. Cox Municipal Airport hardware configurations and the present technical order and FAA advisory circular operating procedures for category III landings. After model verification, the model will be adapted and modified to other aircraft configurations and other potential operating procedures. Finally, the methodologies of the model will be adapted and extended to other tests involving landing studies and tests.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0027, HELICOPTER TRANSMISSION VIBRATION AND NOISE REDUCTION PROGRAM

J. Sciarra, Boeing Co., Vertol Division, *P.O. Box 16858, Philadelphia, Pennsylvania* 19142 (DA0D3930; DAAJ02-74-C-0040)

To generate clear, concise and usable, analytical tools that would, during the design stage of a program, allow the design team the capability to perform trade studies that would yeild drive train components that are dynamically quiet, with inherently longer life and reduced vibration and attendant noise levels.

(1) Construct analytical prediction technique and predict vibration/noise levels of baseline transmission; (2) refine analysis/design and fabricate components to reduce vibration/noise levels of baseline transmission; (3) test modified transmission; (4) compare results and conduct users' conference.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Applied Technology Lab.

1.0028, RESEARCH ON POLYVINYLIDENE FLUORIDE (PVF) TRANSDUCERS FOR NONDESTRUCTIVE TESTING (NDT) APPLICATIONS

W. Scott, U.S. Dept. of Defense, Navy, Naval Air Development Center, Aircraft & Crew Systems Tech Directorate, *Warminster, Pennsylvania* 18974 (DN881177)

(1) To determine the feasibility of using polyvinylidene fluoride (PVF2) as an active transducer element for NDT applications (e.g., pulse echo transducers, surface wave transducers and transducer arrays). (2) To evaluate the advantages of cost reduction, weight reduction and increased flexibility gained by replacing ceramic transducers with PVF2 transducers.

Fabrication techniques will be developed for incorporating PFV2 films into various types of conventional and beam-forming transducers. A number of mechanically flexible transducers will be fabricated for use in the inspection of parts with complex geometries such as compound curvatures. These transducers will be evaluated for materials and components for which they may be particularly suitable (e.g., airfoils and fir tree sections of turbine blades, composite materials, ceramics).

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Development Center

1.0029, FEASIBILITY DEMONSTRATION OF A RETARDATION AND AUTOMATIC FLOTATION (RAFT) SYSTEM FOR THE 'VERTREP' MISSION

W. Wiesmann, U.S. Dept. of Defense, Navy, Naval Air Development Center, Aircraft & Crew Systems Tech Directorate, *Warminster, Pennsylvania* 18974 (DN681034)

Demonstrate the feasibility of a helicopter installed system designed to provide deceleration during free fall and subsequent flotation of high-value cargo that has been intentionally jettisoned or inadvertently dropped during vertical replenishment operations over water. Automatic deployment of the system is planned to prevent specified levels of damage to the cargo upon impact with the water to avert sinking and to facilitate recovery by surface ship or helicopter. The system will be readily adaptable to all helicopters which are normally used in the VERTREP mission. This work is supported by work units PH104B and PH104B1.

It is planned to study, analyze, design and test equipment to facilitate recovery of a nuclear weapon or other high-value cargo which is separated from a helicopter during vertical replenishment operations over water.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

1.0030, THEORETICAL ANALYSIS ON THE BOUNDARY LAYER DEVELOPMENT OVER A SLOTTED WIND TUNNEL WALL

C. Tirres, University of Tennessee, Knoxville Campus, Graduate School, *W. Cumberland Ave. S.W., Knoxville, Tennessee* 37916 (NCA 2-772901)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

1.0031, DESIGN CONCEPTS FOR LATERAL ROLL-OVER PROTECTION

R.G. Fox, Bell Helicopter Co., *P.O. Box 482, Fort Worth, Texas* 76101 (DA0E3795; DAAJ02-77-C-0078)

To develop concepts which will provide protection to occupants for Army aircraft involved in roll-over accidents.

Failure modes of cockpit and cabin areas of aircraft involved in roll-over accidents will be investigated and concepts will be developed to strengthen side and upper fuselage members and to incorporate lateral energy absorbing techniques into the structure.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Research & Technology Lab.

1.0032, ON THE POWER-SPECTRAL DENSITY OF THE DYNAMIC RESPONSE OF AN AIRCRAFT TO NON-HOMOGENEOUS ATMOSPHERIC TURBULENCE

G. Trevino, Del Mar College, Undergraduate School, Dept. of Physics, *Baldwin & Ayers, Corpus Christi, Texas* 78404 (NSG 1615)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

1.0033, DURABILITY METHODS DEVELOPMENT

J.W. Morrow, General Dynamics Corp., *P.O. Box 748, Fort Worth, Texas* 76101 (DF140660; F33615-77-C-3123)

Current Air Force structural integrity policy requires that an Air Force airframe shall be designed such that the economic life is greater than the design service life when subjected to the design service loads/environment spectra. This is necessary to minimize cracking or other structural or material degradation which could result in excessive maintenance or functional problems. Compliance with this policy requires the ability to predict the economic life of an airframe. The objective of this program is to develop and verify the durability methodology necessary to predict the economic life of advanced structures. The results will be used to design more durable military aircraft structures.

Durability methods shall be developed based on a crack growth damage accumulation approach using an equivalent initial quality concept and a statistical approach employing a reliability based model. The most promising of these methods will be evaluated and verified using quantitative structural cracking data obtained from high-time service structures or full-scale test articles. The results will be documented in the form of a durability design handbook.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0034, VSTOL AIRCRAFT LAUNCH AND RECOVERY MODEL DEVELOPMENT

V.J. Wolko, Vought Corp., *P.O. Box 5907, Dallas, Texas* 75222 (DN881371; N62269-77-C-0038)

To develop a computerized model to predict the dynamic response of piloted VSTOL aircraft in takeoff and landing from small platform ships. This contract supports work unit ZA601, Agency Accession No. 681080.

A computer program will be developed which computes the nonlinear propagation of the mean and variance of all model variables as a function of time.

SUPPORTED BY U.S. Dept. of Defense, Naval Air Development Center, Aircraft & Crew Systems Tech Directorate

1.0035, POTENTIAL IMPACTS OF AIRCRAFT NOISE - RELATED LANDING FEE CHARGES

G.R. Fullerton, Computer Sciences Corp., Infonet Division, *1701 N. Fort Meyer Dr., Arlington, Virginia* 22209 (FA78WA-4163; FA161629 (TRAIS NO.))

Growing levels of airport proprietor use restrictions have been evidenced over recent years as a reaction to noise complaints. One device which may be considered by the propietor is a noise-related landing fee. The intent of this effort is to examine the potential impacts of such an approach. The contractor shall develop a methodology to relate aircraft noise charges to aircraft noise abatement costs, and construct a technique to estimate the impact of noise abatement charges on each airport's revenues.

SUPPORTED BY U.S. Dept. of Transportation, Federal Aviation Admin.

1.0036, HT-ST 72-3 ADVANCED STRUCTURAL DESIGN CONCEPTS FOR ARMY AIRCRAFT

I.E. Figge, U.S. Dept. of Defense, Army, Aviation Research & Development Command, Air Mobility Research & Development Lab., *Fort Eustis, Newport News, Virginia* 23604 (DA0C4009)

To develop improved structural design concepts through fabrication and test of structural components utilizing composite

materials, to establish payoffs in increased structural efficiency, reduced vulnerability, increased safety and reliability, and reduced fabrication costs of future Army aircraft systems.

Tetra-core panels and shafts will be fabricated and basic structural characterization determined. A tetra-core secondary structure will be designed, fabricated and structurally evaluated. Data will be evaluated and a report written showing the comparative results in terms of structural efficiency, productivity, survivability and risk. Various structural concepts for an AH-1G sync elevator will be evaluated to determine the optimum cost and structural design. A detail design will be conducted on the selected concept.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Air Mobility Research & Development Lab.

1.0037, CH-47 RAPID INTERNAL CARGO LOADING AND RESTRAINT SYSTEM

Unknown, U.S. Dept. of Defense, Army, Aviation Research & Development Command, Air Mobility Research & Development Lab., *Fort Eustis, Newport News, Virginia* 23604 (DA0E3770)

The objective of this task is to provide a concept design and to build a full-scale, operational mock-up of a rapid internal cargo loading and restraint system for this CH-47. This mock-up shall be used to demonstrate the technical feasibility and assist in determining the user desirability for a system to rapidly load, unload and restrain MAC System 463l and standard Army 40 inches x 48 inches wooden pallets aboard a CH-47.

A system concept layout shall be devised to provide a rapid internal cargo loading and restraint capability for the CH-47. The system shall require no aircraft modifications, will employ current technology and use off-the-shelf hardware. The necessary hardware shall be purchased and/or fabricated, and a full-scale operational mock-up system will then be assembled and installed in a dedicated CH-47. The system shall be demonstrated using dummy loaded 463l and 40 inches x 48 inches wooden pallets.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Air Mobility Research & Development Lab.

1.0038, HT PP 78-05 - FUEL SYSTEM CONTAMINATION TOLERANCE - ARMY HELICOPTERS

K. Smith, U.S. Dept. of Defense, Army, Aviation Research & Development Command, Applied Technology Lab., *Fort Eustis, Newport News, Virginia* 23604 (DA0E3821)

To establish realistic limits to the tolerance of a suction fuel system typical of those used on Army gas turbine helicopters.

Contaminant levels presently being found in today's Army battlefield environment will be related to the capacity of the suction fuel system filtration. This house task will integrate the results of an in-house experimental investigation of suction fuel system performance with results of a fuel sampling survey with MERADCOM (AFLRL).

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Research & Technology Lab.

1.0039, HT ST 76-26 - RPV COST AND WEIGHT REDUCTION INVESTIGATION

Unknown, U.S. Dept. of Defense, Army, Aviation Research & Development Command, Applied Technology Lab., *Fort Eustis, Newport News, Virginia* 23604 (DA0E3835)

The technical objective is to determine methods for reducing weight and cost of RPV structural components. Particular emphasis is to be placed on the capabilities of manufacturing structural shapes and attachment points in a cost-effective manner.

Using the basic aquila airframe design, or realistic vehicle structural weight will be selected. Various manufacturing techniques will be evaluated to determine which technique offers the best compromise between lightest weight and longest life. The applicability of these methods will be determined by the fabrication of selected component part of the aquila. Weight and cost comparison will be made for the various structural concepts.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Research & Technology Lab.

1.0040, HIGH-SPEED ROTOR BALANCING 15080-E

W.D. Pilkey, University of Virginia, School of Engineering & Applied Science, Dept. of Aerospace Engineering, *Garrett Hall, Charlottesville, Virginia* 22903 (DA0F9129; DAAG29-78-G-0019)

To investigate new techniques for balancing, analyzing, and designing flexible rotating shafts. Relevance - this research is particularly important for balancing rotors and shafting of helicopters as well as for high-speed turboshaft engines.

Analytical and numerical methods will be used and experimental measurements will be made to get accurate values for the unbalanced inertial forces. The difference between measured and computed responses will be minimized.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

1.0041, HELICOPTER FLOW FIELD ANALYSIS

Dvorak, Analytical Methods Inc., *110 116th Ave. S.E., Bellevue, Washington* 98004 (DA0D4112; DAAJ02-77-C-0028)

Current helicopters have parasite drag levels of up to ten times as great as fixed wing aircraft. The commensurate poor cruise efficiency results in a substantial degradation of potential mission capability. This problem is primarily due to bluff body flow separation. Therefore, the objective of this contract is to improve helicopter drag prediction by developing an analytical method for predicting pressure distributions in separated flow regions behind bluff bodies. Since the majority of helicopter drag at high speed is due to flow separation, the method, if successful, will allow greatly improved drag predictions for a particular design.

The approach is to combine existing three-dimensional potential flow analysis methods with a boundary layer program to predict the skin friction contribution to drag, the position where flow separation occurs on the body, and the pressure distribution over the surfaces in the separated flow regions. The existing computer program developed under contract DAAJ02-75-C-0036 'Investigation of Three-dimensional Flow Separation on Fuselage Configuration' will be improved by modeling the separated flow region with vortex singularities in order to more accurately predict the base pressure on bluff bodies. The program will then be used to predict the drag of the HLH and BO-105 helicopters to prove its validity as a design tool.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Air Mobility Research & Development Lab.

1.0042, EVALUATION OF BLADE TIP PLANFORM EFFECTS ON HOVER PERFORMANCE - ARMY HELICOPTER

B. Maskew, Analytical Methods Inc., *110 116th Ave. S.E., Bellevue, Washington* 98004 (DA0D4081; DAAJ02-76-C-0069)

To develop a mathematical analysis, based on lifting surface theory, for the prediction of helicopter rotor performance in hover and in a vertical climb.

Portions of existing analyses will be modified and combined to provide an analysis capable of modeling rotor blades with arbitrary radial variations in planform, twist, and airfoil section. The analysis will be based on the vortex lattice method and will include a free wake analysis, a boundary layer analysis, and representations of blade thickness, flow viscosity, and flow compressibility effects. This analysis will be used to predict C sub P - C sub T curves and blade loading distributions to be correlated with existing test data and to be compared with the corresponding predictions from a lifting line analysis and a blade element momentum analysis.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Applied Technology Lab.

1.0043, AIR CYCLE MACHINE LIFE OPTIMIZATION
A. Lloyd, Boeing Co., *7555 E. Marginal Way S., Seattle, Washington* 98124 (DF141160; F33615-78-C-3407)

This work unit supports the ongoing program to develop a closed-loop environmental control system utilizing a shaft powered positive displacement air cycle machine within the loop. Positive displacement air cycle machine's performance and life can be increased through improved design of lubrication, materials, bearings, and seals. The objective of this work unit is to optimize components and elements of the air cycle machine which most effect life and mean-time-between-failures (MTBF). The result will be a significant improvement in the life cycle cost associated with aircraft environmental control systems with a four-fold increase in MTBF over conventional air cycle machines.

Develop designs for bearings, vanes and lubrication components for the positive displacement air cycle machine. Bench test such components to evaluate life and durability characteristics. Incorporate promising component designs into a complete air cycle machine (ACM) and test to determine performance and failure/life data base.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0044, BOUNDARY CONDITION AT A WIND TUNNEL WALL FOR A LIFTING WING BODY COMBINATION AT LOW SUPERSONIC SPEED
S.E. Nyberg, Aeronautical Research Inst., *Box 11021, Bromma, Sweden* (DF048170; AFOSR-77-3282)

AF function - aerospace vehicles, airbreathing propulsion. Deficiency - lack of adequate correction methods for wind tunnel data for lifting configurations at transonic speeds. Objective - to experimentally and, if possible, theoretically determine the wall-boundary conditions for a lifting wing-body model at high transonic speeds. How work contributes - wind tunnels are often mainly used for development testing of aircraft and missiles. While tests have shown that for non-lifting models, the wall interference is far from negligible and that the results can in most cases be considered as acceptable for routine testing, very little is known about the required wall characteristics for a lifting aircraft configuration. If the wall criteria resulting from this investigation agree reasonably well with the criteria used for the development of existing tunnel walls, the assumption that these walls are the most suitable for routine testing will be confirmed. If the results disagree new ideas will be generated concerning necessary modifications of existing walls or possible new wall configurations will be proposed.

By measuring the flow about a hypothetical cylindrical surface surrounding a lifting model the boundary conditions at a hypothetical test section wall will be determined. Comparison will be made with the calculated flow around the same wing-body combination using a computer program already available at FFA.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

ASTRONAUTICS

Includes Astronautics (general); Astrodynamics; Ground Support Systems and Facilities (space); Launch Vehicles and Space Vehicles; Space Transportation; Spacecraft Communications; Command and Tracking; Spacecraft Design, Testing, and Performance; Spacecraft Instrumentation; and Spacecraft Propulsion and Power. For Related Information See Also Aeronautics.

2.0001, DYNAMICS AND CONTROL OF LARGE FLEXIBLE SPACECRAFT
L. Meirovitch, Virginia Polytechnic Inst. & State University, School of Engineering, Dept. of Engineering Science & Mechanics, *Blacksburg, Virginia* 24061 (NCC 1-4)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

CHEMISTRY AND MATERIALS

Includes Chemistry and Materials (general); Composite Materials; Inorganic and Physical Chemistry; Metallic Materials; Nonmetallic Materials; and Propellants and Fuels.

3.0001, STATISTICAL ANALYSIS OF STEADY STATE COMBUSTION OF COMPOSITE SOLID PROPELLANTS
R.L. Glick, Thiokol Corp., Chemical Division, *Huntsville, Alabama* 35807 (DF044910; F49620-76-C-0008)

AF function - nearly all future Air Force rocket propulsion systems will use solid propellants. Deficiency - current capabilities do not permit the prediction of steady or unsteady combustion behavior of these propellants. Objective - this research is to predict the steady and unsteady combustion characteristics through detailed computer modeling of the burning. How work contributes - when successful, this work will permit choosing accurate formulations of complete families of propellants to meet desired performance characteristics after a very few number of relatively inexpensive tests.

Recent advancements in steady-state, composite propellant combustion modeling have been made by assuming that the topography of the burning surface is a fuel plain dotted with concave and/or convex oxidizer surfaces and the macroscopic flame structure is an ensemble of non-interacting quasi-one-dimensional flames. By describing the flames in the ensemble with a modified BDP model and employing statistical concepts, a combustion model for additive free propellants with mixed, polydisperse, spheroidal oxidizer has been developed. Moreover, a strategy for including binder and oxidizer melts within the framework of the model has been developed, but not implemented. Consequently, major impediments to physically realistic modeling are believed to be associated with interacting flames, additives, nonplanar fuel surface, and interacting binder and oxidizer melts. Proposed research is directed at inclusion of melts and interactions in the model. Melt effects will build upon past work and interactions will build Miller's approach.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0002, LOW EXHAUST SIGNATURE PROPULSION
W.W. Wharton, U.S. Dept. of Defense, Army, Missile Research & Development Command, Technology Lab., *Redstone Arsenal, Huntsville, Alabama* 35809 (DA0F1081)

To develop propellants with low smoke content and with improved properties, particularly service life and burning rate improvements in the region of 0.7 to 1.5 inches per second.

The approach is to investigate the crosslinked double base propellants, particularly those containing HMX replacement of nitroglycerin and using inert binders.

SUPPORTED BY U.S. Dept. of Defense, Missile Research & Development Command, Propulsion Directorate

3.0003, AN INVESTIGATION OF TOXIC HAZARDS FROM BURNING MATERIALS IN CONTROLLED FIRES
Unknown, California State University & Colleges, San Jose State University, Graduate School, *Washington Sq., San Jose, California* 95192 (NCC 2-2)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

3.0004, A STUDY OF FIBER MATERIALS FOR USE IN TEMPERATURE RESISTANT FIBER REINFORCED COMPOSITES
R.N. Anderson, California State University & Colleges, San Jose State University, School of Engineering, Dept. of Materials Sciences, *Washington Sq., San Jose, California* 95192 (NCC 2-3)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

3.0005, NAVY ENVIRONMENT - CATALYTIC REMOVAL OF TOXIC GASES
D.A. Vroom, Intelcom Rad Tech, *7650 Convoy Ct., San Diego, California* 92138 (DN223249; N00014-77-C-0255)

The Navy has a keen interest in devising new methods for producing nitrogen-based explosives and rocket propellants. In-

vestigating the chemisorption of nitrogen and the chemistry of reactive nitrogen atoms on catalytically active surfaces will provide information on novel methods for producing nitrogen compounds by catalytic means. Also, nitrogen surface interactions are involved in such applications as rocket thrusters. A study of decomposition reactions of nitrogen compounds such as hydrazine will lead to improved methods of handling, storing and transporting nitrogen-based propellants and explosives.

Low-energy electron diffraction, Auger electron spectroscopy, mass spectrometry and molecular beam techniques will be used to study surface chemical reactions of nitrogen and its compounds on single and polycrystalline surfaces of platinum, iron and other group VIII transition metals. The study will include an investigation of the decomposition of hydrazine and nitrous oxide on catalytically active surfaces.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

3.0006, DEFINE AND DEVELOP A COMBINED HAZARD INDEX METHODOLOGY FOR RANKING AIRCRAFT MATERIALS FOR COMBUSTION

Unknown, McDonnell Douglas Corp., *3855 Lakewood Blvd., Long Beach, California* 90808 (FA77WA-4019; FA160426 (TRAIS NO.))

The combined hazard index shall be time scaled against a specific postcrash cabin fire environment and cover an assumed maximum emergency evacuation period of five minutes. If a specific combustion hazard becomes critical within the five-minute limit, it shall be identified and accounted for in the combined hazard ranking. The cabin fire environment shall be simulated by full-scale tests representative of an actual post-crash accident scenario and fire.

SUPPORTED BY U.S. Dept. of Transportation, Federal Aviation Admin.

3.0007, HIGH-TEMPERATURE OXIDATION AND MECHANICAL PROPERTIES OF SILICON NITRIDE

D.D. Cubicciotti, S R I International, *300 Ravenswood Ave., Menlo Park, California* 94025 (DF044600; F44620-76-C-0116)

AF function - ceramic turbine engines for remotely piloted vehicles (RPV) and auxiliary power units (APU) are being developed by the Air Force, Army, Navy and NASA. Deficiency - there is a deficiency in the present knowledge of the response of these materials to degradation in hostile turbine environment over extended time periods. Short time exposure experiments look encouraging; however, there is a need for careful study into the degradation of mechanical properties as a result of chemical attack in turbine atmospheres. Objective - this research seeks to establish fundamental understanding of the chemical and mechanical behavior of hot pressed silicon nitride in load-bearing turbine environments. How work contributes - this important data is required in order to establish the design allowables for ceramic turbine engine development.

Slow crack growth, creep and tensile fracture of hot pressed silicon nitride will be determined. The relationship of corrosion and chemical diffusion to mechanical properties will be determined. Mass analysis of the gaseous products will be determined as well as the total weight gained during oxidation.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0008, CATALYTIC OXIDATION REACTIONS ON GROUP VIII METAL PARTICLES SUPPORTED ON SINGLE SINGLE CRYSTAL

M. Boudart, Stanford University, School of Engineering, Dept. of Chemical Engineering, *Stanford, California* 94305 (NCA 2-745908)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

3.0009, SPECTROSCOPY OF MINOR CONSTITUENTS IN THE EARTH'S STRATOSPHERE

F. Bonomo, University of Denver, Graduate School, *2115 S. University Blvd., Denver, Colorado* 80210 (NCA 2-205901)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

3.0010, FRACTURE AND FATIGUE CHARACTERIZATION OF AIRCRAFT STRUCTURAL MATERIALS UNDER BIAXIAL LOADING

D. Jones, George Washington University, Graduate School, *901 23rd St. N.W., Washington, District of Columbia* 20037 (DF045860; AFOSR-76-3099)

AF function - to contribute to a better understanding of fatigue and fracture processes for structural materials so that their life-cycle serviceability might be optimized. In this manner, Air Force flight vehicles can, ultimately, be much improved. Deficiency - a better understanding about flaws and their associated effects under biaxial loading will allow designers to consistently improve flight worthiness. Objective - this research program is given to the problem of understanding the effect of biaxial loads on cracked metal specimens. How work contributes - better knowledge about the behavior of structural materials under biaxial stress conditions should serve to improve Air Force flight systems and their components.

The primary emphasis of the analytical research effort will be to formulate the proper foundation for fracture mechanics applications under biaxial applied loads. The experimental portion will emphasize the determination of the effects of biaxial applied loads on the fracture toughness and on fatigue crack growth rates.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0011, DOUBLE LAYER STRUCTURE AND ELECTRODE KINETICS

R. DeLevie, Georgetown University, School of Arts & Sciences, Dept. of Chemistry, *3800 Reservoir Rd. N.W., Washington, District of Columbia* 20007 (DF043940; AFOSR-76-3027)

AF function - electrical power for aircraft, satellite, and various subsystems is the source that keeps our communication systems and flight operations active. Deficiency - longer life, lighter weight, higher energy-density batteries are needed to meet the various operational requirements of the Air Force. Objective - investigations will be carried out on the double layer structure at the electrolyte/electrode interface by a combination of recently developed techniques. These methods will be used to test and calibrate liquid metal electrodes and solid electrodes. How work contributes - information on specific adsorption and on double layer potentials are crucial to the refinement of electrode kinetics, electrocatalysis, and problems related to the electrode/electrolyte interface.

Using the recently developed technique, the kinetic probe method, double layer potential measurements will be made on electrolyte mixtures and solid electrodes. This method will be applied to the study of ionic strength mixtures of alkali fluorides, pseudohalides, nitrates and perchlorates, as well as aqueous buffer mixtures such as phosphate, citrate, and borate. The results will be directly useful for kinetic investigations. Kinetic probes will be used to study double layer potentials at the solid electrode/water interface, i.e. platinum, nickel, zinc and various carbons. Attempts will be made to apply bubble pressure, ultra-fast admittance (Fourier-transform), and kinetic probe techniques to double layer effects on ion adsorption isotherms in dilute solutions, and to the simultaneous measurement of kinetic and thermodynamic data where electrochemical reactants, intermediates, or products are strongly adsorbed.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0012, APPLICATION OF MAGNETIC MATERIALS

D.W. Forester, U.S. Dept. of Defense, Navy, Naval Research Lab., *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN120032)

To exploit and improve the useful properties of existing magnetic materials. There is a clear Navy and DOD need to further develop devices such as magnetically controlled acoustic delay lines and filters, high-power TWT amplifiers, and high-density magnetic memories.

Thin films of metallic-glass and rare earth-transition metal compounds are prepared by electron beam co-evaporation. These films are studied both in and out of device configurations such as overlays for surface acoustic microwave delay lines. Other material forms such as single crystals of high B-H product magnets are also studied. Experimental techniques include magnetostriction, ferromagnetic resonance, Mossbauer spectroscopy, magnetization and X-ray fluorescence.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

3.0013, FRACTURE IN ADVANCED TRANSPARENT COMPOSITES

S. Sutton, U.S. Dept. of Defense, Navy, Naval Research Lab., *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN220065)

Characterize the fracture toughness of advanced transparent plastic composites and of their components in laboratory tests in order to predict their behavior in aircraft canopies and to provide meaningful simplified quality control and specification tests. This will result in increased reliability in service and increased efficiency in design.

Evaluate current techniques and devise new techniques as needed for determining the fracture toughness of plastic glazing materials of current interest, using fracture mechanics concepts. Determine the toughness characteristics of these materials, as a function of specimen geometry, thickness, rate of loading, and temperature. Study the relation between properties of the plastic composites and of their components.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

3.0014, VORBIX AUGMENTATION DEVELOPMENT

R.S. Reilly, United Technologies Corp., Government Products Division, *P.O. Box 2691, West Palm Beach, Florida* 33402 (DN796807; N0019-76-C-0553)

Evaluate mixed-flow augmentation improvements derived from a unique vortex burning and mixing (vorbix) concept. Specific goals include increased combustion efficiency (more than 90%) over a complete a/b fuel schedule, improvement in a/b stability, continuous a/b fuel flow modulation and significant length reduction potential.

Design and fabricate a full-scale, flight-type vorbix augmentor followed by instrumentation and operational check-out on an F401 test vehicle. Contingent on successful sea level test results, the experimental vehicle will be evaluated throughout a typical flight envelope in a NAPTC test cell with emphasis in the upper left hand corner.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Propulsion Test Center

3.0015, CHEMISTRY OF ELECTRONICALLY EXCITED STATES OF ATOMS, DIATOMIC MOLECULES AND DIATOMIC IONS 12197

D. Setser, Kansas State University, School of Arts & Sciences, Dept. of Chemistry, *Anderson Hall, Manhattan, Kansas* 66502 (DA0E8980; DAHC04-75-G-0018)

To study the chemistry of electronically excited states of atoms, diatomic molecules, and diatomic ions. The proposed research should yield kinetic information such as energy transfer rates and vibrational relaxation data on electronically excited states of atoms, molecules, and ions. These results will have direct application in the evaluation of the potential of proposed laser systems. Potential for long-range usage of the results lies in the Army's upper atomspheric research program.

Spectroscopic analysis of experiments on species including N sub 2 (A(3)sigma u (plus), CO (A(3) pi), O sub 2 (plus) (A), and CO(plus) (A(2)pi) will be conducted in a flowing afterglow apparatus. These studies will yield determinations of energy transfer rate constants, insight into the mechanism for vibrational relaxation, identification of product states, and thermochemical and spectroscopic data.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

3.0016, ELECTROPLASTIC EFFECT IN METALS

H. Conrad, University of Kentucky, School of Engineering, Dept. of Metallurgical Engineering & Materials Science, *Limestone & Euclid, Lexington, Kentucky* 40506 (DF047130; AFOSR-77-3203)

AF function - Russian scientists have recently reported that plastic deformation of aerospace metals is strongly influenced by impressed electric fields and currents. This research offers a fundamental study of this phenomenological event so that aerospace vehicles, propulsion systems and structural materials might thereby be improved. Opportunity - a scientific explanation of the Russian breakthroughs in this area does not now exist. The opportunity and need for this research is critical for the national engineering community and results are urgently required. Objective - the objective of this work is to characterize the electroplastic effect in aerospace titanium and its alloys. The phenomena are to be interpreted in terms of micromechanics and extended to real systems involving metalworking problems of solid mechanics. How work contributes - part of the AFOSR mission is to provide a scientific understanding for complex engineering or technological problems. This research will serve the interests of the U.S. Air Force by giving solutions to foreign technology problems which are not yet understood.

Experimentally, this proposed research will evaluate the decrease in flow stress during uniaxial deformation at a constant strain rate and the attendant increase in creep rate which occurs upon the application of current pulses of short duration. The mechanical test variables which will be studied include temperature (78 to 1100K) and intermediate strain rates. The electrical variables will include voltage, current, wave form (including d.c. plus a.c. and frequency), number of carriers and pulse duration. Analytically, the program will attempt to interpret the behavior in terms of micromechanics and the interaction of electrons with dislocations. Generally, the data and results will be summarized as to their applicability for improved metalworking methods.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0017, DEVELOPMENT OF KEVLAR-29 DECELERATOR SYSTEMS MATERIALS

N.J. Abbott, Fabric Research Labs. Inc., *1000 Providence Hwy., Dedham, Massachusetts* 02026 (DF139500; F33615-77-C-3007)

Deployable aerodynamic decelerator systems are germane to the accomplishment of many military missions. These systems are employed to decelerate, recover and/or position payloads in a wide spectrum including small electronic countermeasure devices, escaping aircrew members, weapons and entire aircraft. Evolution of decelerator system requirements has resulted in the necessity to increase effective performance per unit of decelerator system weight and volume. Yarns of Kevlar-29, an aeromatic polyamide fiber currently in limited production, have been used in fabricating experimental decelerators which have exhibited up to fifty percent weight and volume savings over similar strength nylon decelerators while demonstrating comparable performance. The objective of this work unit is to develop a spectrum of Kevlar-29 textile materials from which decelerator system components can be designed, to ascertain the mechanical properties of these materials and to generate specifications for each material. Specifications for a spectrum of Kevlar-29 textile materials will provide decelerator system designers with the capability to reduce weight and volume requirements. These reductions allow increased mission effectiveness in the forms of longer range, reduced fuel costs, and wider and more effective decelerator system applications.

For each specified material strength, type and dimension, braiding or weaving technique and yarn configuration combinations will be chosen based on previous experience. These com-

binations will be utilized to produce small quantities of material which will be tested to determine relative properties to be used in optimizing the material. Testing of the optimized material will be accomplished to reveal detailed material properties, seamability and suitability. As more materials evolve and experience in Kevlar weaving and braiding accrues, previous material specifications will be updated as necessary to incorporate findings.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

3.0018, STUDY OF THE MAGNETIC FIELD DEPENDENCE OF THE MOLECULAR Ni(CO)4 FORMATION RATE

M.S. Dresselhaus, Massachusetts Inst. of Technology, School of Engineering, Dept. of Electrical Engin, 77 *Massachusetts Ave., Cambridge, Massachusetts* 02139 (DF046200; AFOSR-77-3130)

AF function - this proposed research primarily falls in the 2.2 research objectives which deal with materials which are specifically designed or used for their environmental resistant qualities. Materials response to hostile environments in general are included excepting electronic materials. Research includes work on heat shield, nose cap, leading edge and hot surface panel materials which accomplish their protective function by ablation, reradiation, insulation, transpiration cooling or heat sink concepts. The mechanisms responsible for materials degradation in hostile environments must be studied to provide a rational basis for developing environmentally resistant materials and to be able to predict materials response and life time service. Deficiency - one needs to obtain fundamental thermochemical and thermophysical properties data on materials which form oxides or chemically interact with oxygen. Recent improvements in fabrication and material processing techniques have led to the development of many materials which are very stable in high-temperature oxidizing environments. Objective - the proposed research program addresses the general question of magnetic field dependence of chemical reactions catalyzed by transition metals. More specifically, they propose to continue our study of the magnetic field dependence of the production rate of the molecular gas Ni(CO)4 formed by passing CO gas over a Ni surface. Contribution - this research is a part of a comprehensive program in statistical mechanics of real systems.

A research program is proposed to address the general question of the effect of a magnetic field and the magnetic state on chemical reaction rates, for reactions which are catalyzed by transition metals. In particular, they propose to look for the large and oscillatory magnetic field dependence of the production of the molecular gas Ni(CO)4 as reported by a group of Russian workers. If reproduced, these effects will be studied in detail. Experiments will also be carried out in search of Hedvall effect (change in chemical reaction rate due to the magnetic state) in the nickel carbonylation reaction. Using infrared and Raman spectroscopy, this reaction will be studied to identify active surface sites and rate-limiting steps in this chemical process. (Text abridged.)

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0019, MICROSTRUCTURE AND PROPERTIES OF SPECIALLY PROCESSED STEELS FOR INTEGRAL STRUCTURAL APPLICATIONS

C.F. Hickey, U.S. Dept. of Defense, Army, Army Materiel Development & Readiness Command, Materials & Mechanics Research Center, *Watertown, Massachusetts* 02172 (DA0D4819)

The objective of this investigation is the optimization of the ballistic and mechanical properties of armor by utilizing steel produced by special processes such as electroslag remelt (ESR), vacuum induction melting (VIM), or vacuum arc remelt (VAR). In general, the ballistic properties of steel increase with increased strength (hardness) to some inherent limit, dependent on material toughness. These specially processed steels have improved toughness which permits this utilization at higher strengths. In addition, this would also provide increased ballistic protection to critical components such as landing gears, drive shafts, helicopter masts, wing boxes on aircraft, and spars of helicopter blades. This effort is aimed at determining the microstructure which produces optimum properties in these specially processed alloys through controlled heat treatment. This should provide a means of enhancing aircraft survivability and combat vehicle protection.

Determinations of both strength and toughness of specially processed 4340 steel after various combinations of thermal treatments will be made. Work will be continued on the influence of impurity element additions to a high-purity Ni-Cr-Mo steel master alloy. These results will define the degree of toughness as well as the ballistic properties attainable with very low amounts of impurities.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Materials & Mechanics Research Center

3.0020, DEVELOPMENT OF ADVANCED CERAMIC RADOME MATERIALS

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Materials for advanced hypersonic missile radomes are required for velocity regimes beyond the capacity of slip cast fused silica. The careful addition of high-purity fused silica fibers to the basic fused silica slip should result in a radome structure of higher mechanical strength (and erosion resistance) and equivalent dielectric properties. This program will optimize slip casting and sintering techniques to fabricate high-purity fiber reinforced slip cast fused silica. Pacing problem - radome materials to Mach 6. Thrust - hypervelocity weapons.

Two separate approaches will be undertaken to develop fiber reinforced fused silica radome structures. (1) The principal effort will be devoted to developing a technique for dispersing chopped fused silica fibers in a fused silica slip. A commercial model high-speed Waring blender will be used to chop high-purity fused silica fibers to various lengths and then systematically add the fibers to high-purity fused silica slip for the casting of prototype radome structures. This process will allow various fiber contents to be used with the fibers being of known length and upon slip casting the fibers will be randomly oriented. (2) A second approach will use continuous roving of high-purity fused silica which will be coated with a silicone resin and wound onto a radome-shaped mandrel. The resin used for this process is one that will convert to a high-purity amorphous silica upon firing. This filament winding technique will produce radome structures of varying fiber content with the fibers being completely oriented. Several different wrapping techniques will be used to determine the optimum procedure. Radome structures fabricated from both approaches will be tested and evaluated to determine the effects of the fibers on physical, mechanical and dielectric properties.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Materials & Mechanics Research Center

3.0021, THE RELATION BETWEEN THE CHEMICAL AND PHYSICAL STRUCTURE AND THE MECHANICAL RESPONSE OF POLYMERS

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AF function - advanced aircraft utilize structural components in the form of matrices for composite materials, adhesives and transparencies which are subjected to extreme service environments. Deficiency - a basic understanding of the failure mechanisms, and failure mode changes, of polymer glasses is lacking. Objective - this research is to study how the chemical and physical structure of polymeric glasses is related to mechanical response and deterioration in service environments, in particular, moisture and humidity. How work contributes - it is expected that this research will contribute to the understanding which must be established before laboratory simulation tests can be constructed which will predict in-service failures in structural composites.

The structure/failure-process/mechanical-property relations of polymer glasses and how such relations are modified by fabrication and environmental factors will be studied. Studies will continue on polymer glasses with primary emphasis in three major areas - (1) the effects of cyclic heat and/or moisture on the durability of epoxies, (2) the physical structure, molecular interac-

tions and modes of deformation of polycarbonate-diluent systems, and (3) the structure and modes of deformation and failure of aromatic heterocyclic polymers using electron microscopy.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0022, ENERGY AND MOMENTUM EXCHANGE BETWEEN SOLIDS AND GASES

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AF function - aerospace vehicles. Deficiency - lack of knowledge of interactions of gas molecules with solid surfaces. Objective - to complete additional measurements of clean-surface tangential momentum accommodation coefficients on magnetically suspended, spinning balls, and to analyze and prepare for publication a large body of data compiled from the previous work of the principal investigator on momentum and energy accommodation on surfaces of known cleanliness or known coverage with gas molecules. How work contributes - by making generally known the physical details of these interactions and the conditions governing them, it should be possible to make more accurate a-priori predictions of aerodynamic forces as well as to be better able to design around gas contamination processes on spacecraft carrying optical and infrared or ultraviolet sensors or emitting devices.

A large body of raw data accumulated from previous measurements of thermal accommodation coefficients by the principal investigator will be corrected and prepared for publication using recently accomplished measurements of mercury pumping effect and temperature distribution on tungsten filaments. Some additional data points will be taken to complete certain sets of data. Tangential accommodation coefficients will be measured by the magnetically suspended spinning disc method.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0023, PROTECTION OF CAST MAGNESIUM

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The purpose of this task is to determine optimum surface treating and coating systems for protection of cast magnesium alloys and concurrently to ascertain minimal compromise of fatigue endurance of the castings coated with different protective systems. Optimum protective systems are required for use on cast magnesium housing and parts employed in Army helicopters and for housings and mounting plates for weaponry and electronic equipment. This task is in support of major thrusts in aircraft, air-defense, weapons, warhead and guidance systems.

Failures of protective systems applied to cast magnesium helicopter power transmission housing, to arming equipment mounting plates and to housings for electronic sensing and guidance packs have led to premature corrosion and increased maintenance. Where electrical continuity is required, electrodeposited metal barrier coatings are comprised of a copper preplate and a nickel barrier overplate which are used. This system is breeched even in relatively mild environments because of the very unfavorable anode-cathode relationship of metallic coating systems normally specified (Cu-Ni, Cu-Sn, or Sn-Zn). These systems have marked potential protection deficiency. The development of metallic coatings systems which are more compatible with and protective of magnesium under atmospheric conditions containing chlorides and covering the full range of humidity (with periodic condensation) is being pursued. Plated and metal-rich coatings will be considered.

SUPPORTED BY U.S. Dept. of Defense, Armament Research & Development Command, Fire Control & Small Caliber Weapon Systems Lab.

3.0024, SYNTHETIC AND PETROLEUM FUEL DEVELOPMENT

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To develop the capability of operating Navy aircraft on synthetic and nonstandard petroleum fuels by determining the impacts of changes in fuel properties on aircraft systems and support systems.

Conduct a laboratory program that will physically define the meaning of critical fuel properties as pertaining to performance of aircraft component hardware. This work includes tests of components with various fuels; studies of the effects of refining procedures on fuel properties; and tests of fuel properties that impact on aircraft fuel storage and use.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Material Command

3.0025, FATE OF SELECTED AIR FORCE PROPELLANTS AND LUBRICANT ADDITIVES IN THE AQUATIC ENVIRONMENT

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AF function - a number of chemicals including missile propellants and lubricant additives are widely used in Air Force operations. These may be introduced into the aquatic environment through routine operations, spills, and waste-discharge effluents, and are of concern due to their potential toxicity. They may affect man through the drinking water supply, accumulate in the food chain, or be converted to other products with even greater toxicity. Deficiency - little information is available on the environmental fate of Air Force missile propellants and lubricant additives. Objective - this research will address the environmental fate of selected Air Force chemicals to evaluate the hazards associated with their release. The direction of the second year effort is towards the determination of the products of degradation of UDMH in distilled and lake water. How research contributes - results of this study should provide information needed to establish guidelines regarding discharge of Air Force products into water systems subject to state and federal regulations. This research directly supports subarea 1.9, 'Environmental Protection and Toxicological Hazards' and RO 1.9.1, 'Health Effects'.

In the original proposal, it was planned to (1) determine the uptake and metabolism of UDMH by fish, (2) study the uptake and transformation of UDMH by phytoplankton and (3) determine the sorption-desorption characteristics of UDMH in lake sediment. In the light of present findings regarding the high reactivity of UDMH, earlier objectives will be modified to make the study more environmentally realistic. Sorption-desorption studies of UDMH by sediment will be experimentally impractical since the chemical will degrade appreciably during the course of adsorption. Consequently, that phase will be modified with a study of the kinetics and products of degradation of MMH (monomethylhydrazine) along the lines presently adopted for UDMH. Investigation of these two chemicals will mutually complement each other and lead to a better understanding of the factors which influence environmental degradation of the hydrazine fuels. It is also planned to determine the uptake and metabolism of UDMH by aquatic organisms representing different trophic levels such as fish, daphnia and algae. Level of exposure of the organisms will be selected on the basis of toxicity data. (Text abridged.)

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0026, FUNDAMENTAL STUDIES IN FT MATERIALS

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AF function - navigation, surveillance, communication. Deficiency - presently used quartz resonators lack radiation hardening and long-term stability. Objective - to improve quality of resonator materials. How research contributes - fabrication of resonators from this material should result in improved radiation hardening and frequency stability for use in satellites and other Air Force systems.

New solvents will be used in hydrothermal studies to seek improved materials. Addition of specific impurities into quartz by solid-state electrolysis will be investigated.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

3.0027, EFFECTS OF OXYGEN AND WATER VAPOR ON THE COMPRESSIVE FILM STRENGTH OF BOUNDARY FILMS ON IRON SUBSTRATES

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AF function - propulsion systems for advanced aerospace vehicles require improved lubricants which will withstand a wider range of temperature conditions, greater contact loads and higher shear rates. Deficiency - available lubricants continue to fail due to the detrimental effects of water vapor and oxidation. Objective -investigate the effects of atmospheric oxygen and water on boundary film formation. How work contributes - the information gained from this research will be used to formulate improved lubricants for critical AF applications.

Chemical kinetic methodology will be applied to the study of the film-forming process and the behavior of the films will be determined, as manifested by the compressive strengths, with respect to time, temperature, oxygen and water vapor. It is proposed to (1) study rupture strength in controlled atmospheres as a function of relative humidity and O2 concentration, (2) determine the adsorption isotherms of TcP from E-105 solution, (3) measure friction and damping behavior of E-105 films, and (4) study chemical bindering between film and substrate by means of reflection-adsorption spectroscopy.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0028, IN SEARCH OF A THEORETICAL FOUNDATION FOR QUANTITATIVE ULTRASONIC MEASUREMENT OF FRACTURE TOUGHNESS

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SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

3.0029, INTERNAL STRUCTURE AND PHYSICAL PROPERTIES OF CERAMICS, METALS, AND ALLOYS AT HIGH TEMPERATURES

W. Tripp, Systems Research Lab. Inc., *500 Woods Dr., Dayton, Ohio* 45432 (DF680990; F33615-75-C-1005)

AF function - high-temperature propulsion materials. Thermal protective materials and power generator materials. Deficiency - failure of materials to perform at high temperatures due to oxidation, loss of strength or lack of requisite physical, chemical or mechanical properties. Research studies of the kinetics of the degradation of metals and ceramics exposed to reactive environment will be combined with microstructural and compositional studies of the matrix and reaction products to determine the degradation mechanism and to suggest potential material improvements. The relationship of composition, defect structure, and microstructure of selected new ceramic materials to their mechanical and physical properties over a wide range of temperatures will be determined to improve their potential for structural, propulsion, and energy conversion applications. How research contributes - an understanding of the fundamental mechanisms responsible for the mechanical, physical, and chemical properties of materials under extreme conditions of applied stress and temperature is essential if significant long-range improvements in these materials are to be made. Once the mechanisms are known, modifications in material composition, microstructure, and surface condition can be undertaken in a more scientific manner to improve material behavior, and new development efforts.

The structure/property studies will require detailed investigation of the raw material and processing factors that influence microstructural development of metals and ceramics, the role of thermodynamic variables in fixing the defect structure and transport properties of these materials, and the role these factors play in determining the mechanisms underlying physical and mechanical properties of technological importance, such as electrical conductivity, high-temperature corrosion, diffusion, sintering, creep, strength, deformation and fracture.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Materials Lab.

3.0030, RESEARCH IN PROPULSION

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Conduct basic research to provide a technological base in propulsion systems for aircraft application. This program is fundamental and exploratory in nature and is a continuing effort covering aerodynamics and material requirements for small turbine engines.

Analytical and experimental studies are conducted on Army-funded, NASA-administered contracts with private industry and universities. Specific effort is directed toward obtaining aerodynamic and material technologies necessary for designing turbine engines to operate at higher pressure ratios and temperatures.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Air Mobility Research & Development Lab.

3.0031, MICROSTRUCTURAL EFFECTS AND FATIGUE LIFE PREDICTIONS OF NICKEL BASE SUPERALLOYS

S.D. Antolovich, University of Cincinnati, School of Engineering, Dept. of Metallurgical Engin & Mat Sci, *101 Baldwin Hall, Cincinnati, Ohio* 45221 (DF042780; AFOSR-76-2952)

AF function - nickel base superalloys are used in critical jet engine components that experience repeated loads (fatigue) and long hold times at elevated temperatures. Opportunity - these materials can undergo significant microstructural changes when subjected to the combination of high temperatures and moderate stresses which may profoundly affect the fatigue life. However, these changes are not currently incorporated in conventional fatigue life prediction procedures. Objective - this research will determine the effects of microstructural variations in influencing the fatigue life of cast, nickel-base superalloys used for jet engine turbine blades. How work contributes - the results of these tests will be used to develop models of the fatigue process which incorporated microstructural and strain rate effects, and to define the way in which life predictions of notched components can be made using tensile and smooth bar test results.

Experiments will be carried out on rene-80 material in both air and inert environments to unambiguously assess the importance of these changes on fatigue performance. Tensile, notched and smooth bar specimens will be tested as a function of strain rate and microstructure over the temperature range of 1400 to 1800 degrees F.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0032, REACTIVE ATOMIC SPECIES GENERATED AT HIGH TEMPERATURES AND THEIR LOW-TEMPERATURE REACTIONS TO FORM NOVEL SUBSTANCES

P.S. Skell, Pennsylvania State University, University Park Campus, School of Science, Dept. of Chemistry, *211 Whitmore Lab., University Park, Pennsylvania* 16802 (DF052640; AFOSR-78-3634)

AF function - AF flight operations require improved environment resistant and electromagnetic materials. Deficiency - there is a need for high-purity materials for electromagnetic devices and for better methods of depositing environment resistant coatings. Objective - this research involves a study of chemical and physical properties of vaporized metal atoms and their reactions with organic molecules. How work contributes - the work is providing detailed knowledge of the reactions of a large number of metallic atoms which will be useful in preparing high-purity materials and metallic coatings.

The research is aimed at a detailed study of the properties and reactivity of metallic atoms with emphasis on Ti, Al, V, Y, Co, Ni, Nb, Ta, W, Si, C, Ca, Mg, and Be. The objective is to synthesize new and unique compounds and to better understand the chemistry of the free atoms which is not well known at present.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0033, STUDY OF FATIGUE MECHANISMS IN AEROSPACE STRUCTURAL MATERIALS

J. Lankford, Southwest Research Inst., *8500 Culebra Rd., San Antonio, Texas* 78228 (DF051120; F49620-78-C-0022)

AF function - the development of stronger materials by alloying and processing approaches continues to result in both airframe and gas turbine engine alloys that offer the possibility of substantial performance improvements in current and future aircraft. Opportunity -fatigue properties, which are often the life-limiting consideration for these applications, have not always kept pace with the increase in other mechanical properties. Objectives - this research will identify the physical mechanisms responsible for the fatigue behavior of aluminum airframe alloys and titanium engine materials, and define guidelines to meet the property improvements sought by the Air Force. How work contributes - the approach will involve extensive utilization of a scanning electron microscope (SEM) that has been modified to provide two unique capabilities. Selected area channeling contrast and patterns as well as a cyclic loading stage that operates within the viewing chamber of the SEM will both be used to characterize the micromechanisms of deformation and fracture that control fatigue crack initiation and propagation.

In the case of the aluminum alloys, emphasis will be placed on crack tip behavior (plastic zone size and shape) and its relationship to crack growth properties on alloys 2024, 6061, and 7075 and MA87 for both continuous cycling at uniform stress amplitudes and for overload conditions. The titanium program will focus on crack initiation and the very early stages of crack propagation under both continuous cycling and cycling with dwell periods.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0034, LUBRICATION REQUIREMENTS FOR MILITARY VEHICLES

S.J. Lestz, Southwest Research Inst., *8500 Culebra Rd., San Antonio, Texas* 78228 (DA0M3662; DAAR70 78 C 0001)

Investigate lubricant degradation, deposit formation, wear characteristics for current/future military automotive, engineer, aviation power-train systems.

Selected multi-cylinder engines, special single-cylinder engines and/or gear systems and chemical analytical methods are used or developed as required to study lubrication mechanism problems, to check laboratory/field correlation of lubricant compatibility, or to develop laboratory techniques which relate to field performance.

SUPPORTED BY U.S. Dept. of Defense, Mobility Equipment Research & Development Command, Fuels Lubricants & Coatings Div.

3.0035, STUDIES OF SILICON-NITROGEN-PHOSPHORUS COMPOUNDS INCLUDING A NEW SYNTHESIS OF PHOSPHAZENES 16266-C

R.H. Neilson, Texas Christian University, Graduate School, *2800 S. University Dr., Fort Worth, Texas* 76129 (DA0G8941; DAAG29-79-G-0004)

An exploratory study of phosphorus (V) compounds including a new synthesis of phosphazenes will be undertaken. Relevance - this research has the potential to lead to a new synthesis of phosphazenes which is less costly and results in material of higher purity than the currently available method. Phosphazenes have many outstanding properties currently being exploited extensively for numerous Army applications (helicopter seals, low-temperature fuel hoses, flame-proof materials, etc.).

Pentacoordinate silicon-nitrogen-phosphorus compounds will be synthesized and characterized. The thermal decomposition of these compounds leading to a new, general synthesis of phosphazenes will be explored.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

3.0036, DEVELOPMENT OF PRACTICAL MO TECHNIQUES FOR PREDICTION OF THE PROPERTIES AND BEHAVIOR OF MATERIALS

M.J. Dewar, University of Texas, Austin Campus, School of Natural Sciences, Dept. of Chemistry, *200 W. 21st St., Austin, Texas* 78712 (DF039910; AFOSR-75-2749)

AF function - Air Force flight operations have continuing needs for improved structural, environmental resistant and elastomeric materials. Deficiency - a need exists for methods of predicting the best approaches to making new materials. Objective - the purpose of this research is to develop practical procedures for applying fundamental physical theory to the prediction of properties and behavior of organic materials, simple enough, and accurate enough, to be of practical value in the search for new or improved materials of all kinds. How work contributes - the work will provide a basis for the synthesis of desirable new materials without a need for trial-and-error experimental procedures.

Semi-empirical molecular techniques developed by the principal investigator will be applied to a variety of structural and mechanistic problems where experimental data are lacking or difficult to interpret, particularly photochemical reactions and organometallic compounds. The research will involve mainly the MNDO approach to calculations.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0037, THEORETICAL STUDY OF RADIATION EFFECTS IN COMPOSITE MATERIALS FOR SPACE USE

C.K. Chang, College of William & Mary, Christopher Newport College, Undergraduate School, Dept. of Chemistry, *Newport News, Virginia* 23606 (NSG 1614)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

3.0038, EFFECT OF APPLIED STRESS, THERMAL ENVIRONMENT AND WATER IN EPOXY RESINS

L. Nicolais, Universita degli Studi di Napoli, *1 Corso Umberto, Naples, Italy* (DF049200; AFOSR-77-3369)

AF function - advanced aerospace vehicles will achieve higher performance through the use of advanced composite primary structure. Deficiency - there is no acceptable fatigue life prediction method for composites which considers moisture and elevated temperature behavior. Objective - objective of this research is to establish a quantitative description of moisture transport in polymer matrix materials considering environmental conditions, thermal histories and applied stress states. How work contributes - results of this research will contribute to the development of a rational fatigue life prediction methodology.

This research will characterize the mechanical performance and transport behavior of epoxy resins due to elevated temperature and moisture environments. Measurement techniques will be extended to determine the moisture concentration gradient in a polymer. Permeability, diffusion and distrubution coefficient will be determined as a function of lamina thickness and temperature. The presence of compressive forces should reduce the rate and maximum value of water absorption and reduce swelling and will be measured. Effect of a sudden increase in temperature on a swollen material can induce the instantaneous formation of microcavities and cracks. Thermal cyclic experiments will be conducted to study this phenomenon.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0039, ELECTROMAGNETIC AND ELECTROSTATIC EFFECTS ON COMPOSITE MATERIALS

B. Burrows, United Kingdom Atomic Energy Authority, Culham Lab., *Abingdon, England, United Kingdom* (DN881506; N62269-78-C-NONE)

To correct the problems associated with the A7 aircraft pylon electrical cables, a cable redesign program will be undertaken. Redesigned cable assemblies will be built as prototype models and tested to evaluate design improvements and problem solving concept. This contract supports work unit SWK03, Agency Accession No. DN581110.

Cable assembly design requirements will be generated and documented by NADC. The requirements will then be submitted to a contractor for the design and fabrication of prototype models. These prototype models will then be lab tested and fleet evaluated for design and manufacturing adequacy. Finalized documentation will be generated upon satisfactory completion of test and evaluation program.

SUPPORTED BY U.S. Dept. of Defense, Naval Air Development Center, Systems Directorate

ENGINEERING

Includes Engineering (general); Communications; Electronics and Electrical Engineering; Fluid Mechanics and Heat Transfer; Instrumentation and Photography; Lasers and Masers; Mechanical Engineering; Quality Assurance and Reliability; and Structural Mechanics. For Related Information See Also Physics.

4.0001, MISSILE TECHNOLOGY/HYBRID MICROELECTRONICS TECHNOLOGY - MISSILE SYSTEM HYBRIDIZATION

G.D. Little, U.S. Dept. of Defense, Army, Missile Research & Development Command, Advanced Systems Development & Manufacturing Technology Dir., *Redstone Arsenal, Bldg. 5400, Huntsville, Alabama* 35809 (DA0G1083)

The objective of this program is to develop and demonstrate methods of applying microelectric technology to the concept, design, fabrication of missile systems. The second objective is to quantitatively identify and improve heat removal methods of hybrid microelectronic circuitry.

A digital autopilot has been selected as the demonstration vehicle. This system has been designed and partitioned into hybrids. The hybrids and their supporting and interconnecting structure have been designed and fabrication is 98 percent complete. Redesign of digital autopilot, as a result of the environmental and flight tests, will be completed and updated flight models will be fabricated and tested.

SUPPORTED BY U.S. Dept. of Defense, Missile Research & Development Command, Advanced Systems Development & Manufacturing Technology Dir.

4.0002, RESEARCH STUDY - SPACE SHUTTLE IEMC AIR SAMPLER EXPERIMENT

Unknown, University of Alabama, Graduate School, *P.O. Box 2846, University, Alabama* 35486 (NAS 8-33507)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Marshall Space Flight Center

4.0003, SURVEILLANCE - LARGE MIRROR STRUCTURES

W.S. Smith, University of Arizona, Graduate School, *Tucson, Arizona* 85721 (DN875284; N00014-78-C-0282)

The objective of this work unit is to design and theoretically analyze improved large optical structures of a type suitable for satellite-mounted surveillance systems for use in the Navy.

To accomplish the proposed objective, structural forms will be designed with predicted optical surface position control capabilities that exceed those of present designs. The latter are characterized by a diameter-to-thickness ratio of on-the-order of 6:1 with actuators imbedded in the structure. Design degrees of freedom will include depth-of-structure, tiers of actuators, and weight. Figures-of-merit will be defined for expressing the improvements achieved by the new structure designs, and these will be used for comparison and evaluations. The design domain will include mirror diameters from 10-300 meters and wavelength from 1 to 3000 micrometers, with the shorter wavelengths corresponding to the smaller diameters.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0004, MICROELECTRONIC SYSTEMS - ION IMPLANTATION

C.L. Anderson, Hughes Aircraft Co., *3011 S. Malibu Canyon Rd., Malibu, California* 90265 (DN220074; N00014-71-C-0358)

To undertake applied research in electronic materials, processes and devices in order to discover fundamentally better ways to provide reliable high-performance electronic devices and systems. The specific objectives will be to investigate newer, more promising ideas from basic physical principles which will provide fundamental behavior on a modular engineering basis. This in turn should lead to fundamental microelectronic advances in reliability, high efficiency, adaptiveness, and system effectiveness.

The technical approach will be to investigate ion-implantation technology as a means of tailoring the band gap, and as a means of controlling the three-dimensional geometry of junctions in wide band gap materials. The starting material is GaAs.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

4.0005, SEPARATED FLOWS, TURBULENCE PRODUCTION MECHANISMS AND FREE SHEAR LAYERS

S.J. Kline, Stanford University, School of Engineering, Dept. of Mechanical Engineering, *Stanford, California* 94305 (DF037770; F44620-74-C-0016)

Air Force function - advanced airbreathing propulsion devices -aerospace vehicles. Deficiency - prediction methods for turbulent shear flows are inadequate. Objective - increased understanding of the basic flow structure and computational ability for turbulent shear flows, for their interaction with regions of 'inviscid' flow, and their stability with regard to such interactions. How work contributes - improvement in both physical understanding and prediction ability will permit better design of any system (jet engines, turbine blades, diffusers, airfoil sections) in which these flows become limiting or controlling factors.

A combined experimental and theoretical program has been established. On the theoretical side the first priority will be the improvement and extension of the methods for computing separated flows. The experimental program will provide needed data to aid in modeling this critical area. In addition, an experimental and theoretical study of separated flows with reattachment will continue.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0006, ANALYTICAL AND SEMI-NUMERICAL METHODS OF FLOW CALCULATIONS

M.D. VanDyke, Stanford University, School of Engineering, Dept. of Aeronautics & Astronautics, *Stanford, California* 94305 (DF038360; AFOSR-74-2649)

AF function - advanced aerospace vehicles. Opportunity -improvement of present semi-numerical methods used for solving viscous flow problems. Objective - define and refine semi-numerical methods concerned with flow calculations of viscous flows. How work contributes -improvement in the capability to make flow calculations for viscous flows will result in better designs of advanced aerospace vehicles.

Efforts will be concentrated on extending a regular perturbation series to high order by delegating the arithmetic to a computer, examining the analytical structure of the solution, and then from that basis enlarge its range of validity. This will be done by solving various problems in viscous flow.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0007, DEVELOPMENT OF TRANSONIC COMPRESSOR MODEL

R.P. Shreeve, U.S. Dept. of Defense, Navy, Naval Postgraduate School, *Monterey, California* (DN898080)

To develop a small transonic axial air compressor model and establish methods of measuring the performance and flow behavior.

Design, build and test a transonic compressor and compressor test rig, and perform measurements of overall performance and internal flow behavior.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

4.0008, FUNDAMENTAL PROCESSES OF TURBULENT DECAY AND MIXED INTRUSIONS INJECTED INTO STRATIFIED MEDIA

F.K. Browand, University of Southern California, Schcol of Engineering, Dept. of Aerospace Engineering, *3551 University Ave., Los Angeles, California* 90007 (DN475266; N00014-76-C-0211)

This task seeks to find a better understanding of basic turbulence processes occurring in the ocean. This better understanding will help the Navy to improve its capabilities, both offensively and defensively, in various aspects of ASW.

Experimental studies will be carried out on turbulent shear flow, turbulent decay, mixed intrusions in rotating stratified fluids, three, dimensional spreading of mixed intrusions into stratified media, soliton generation in complex brunt frequency distributions, and dynamics of spreading intrusions with double diffusive effects.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0009, AN INVESTIGATION OF THE FLOW DYNAMICS OF UNSTEADY SEPARATED REGIONS

M.S. Francis, U.S. Dept. of Defense, Air Force, Frank J. Seiler Research Lab., *Air Force Academy, Colorado Springs, Colorado* 80840 (DF281760)

AF function - technology base. Deficiency - insufficient knowledge of the flow behavior of unsteady separated flow germane to a wing of a maneuvering aircraft. Research - develop a flow model through extensive theoretical and experimental analysis of an unsteady separated region on an airfoil. How research contributes - results will describe the behavior of unsteady separated flow germane to helicopter rotors, aircraft maneuvering at high angles of attack, and jet engine compressors. Abstract - a combined analytical and experimental investigation will be employed to determine the nature and details of the flow field physics in an unsteady separated region above a lifting airfoil. Models employing the concepts of vorticity and mass transfer will be developed to understand and explain the viscous-inviscid interactions and resultant wing loading characteristics. Wind and water tunnel experiments employing a wing with an oscillating spoiler will be used to verify the theoretical results and provide an understanding of the basic physical mechanisms. The extension of these models to various other flow situations may also be considered dependent upon the nature and characteristics of the preliminary results.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Frank J. Seiler Research Lab.

4.0010, UNCONVENTIONAL SURVEILLANCE TECHNOLOGY

T.A. Chubb, U.S. Dept. of Defense, Navy, Naval Research Lab., *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN320117)

(1) To construct demonstration surveillance and threat warning devices based on the NRL space science program technology.

The NRL space research program provides technological developments useful for surveillance. Promising items are developed to provide demonstration devices. Laboratory field and flight tests are carried out. Applications are in the areas of surface and air attack threat warning, extravisible vision, ocean surveillance from space and aircraft, missile surveillance from space.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Electronic Systems Command

4.0011, INSTRUCTIONAL SYSTEMS DEVELOPMENT

J.F. Funaro, U.S. Dept. of Defense, Navy, Naval Training Equipment Center, Human Factors Lab., *Orlando, Florida* 32813 (DN694005)

(1) Production of a comprehensive ISD document which incorporates detailed management and technical procedures and which can actually serve as an instructional design guide (in the form of job-performance aids) within the Navy. (2) Development of a set of personnel, time and cost factors which can be used in evaluating ISD or in detailed planning for ISD projects. (3) Accumulation of a body of data which supports or refutes the desirability of routinely employing the ISD approach in response to instructional design and development problems.

Maximum utilization will be made of 'lessons learned' from project 5753. A thorough review will be made of all known applications of the ISD approach to aircrew and maintenance training in aviation systems. The review will document the management, technical and econometric procedures employed as well as measures of cost effectiveness realized. The Navy aircraft weapon system development cycle will be reviewed in order to determine the utility of presently required documentation to ISD as well as to establish milestones and constraints for the application of ISD. A guideline for the implementation of the ISD approach in the development cycle of naval aircraft systems will be developed. Specifications, DID's and other documentation needed to define required contractor and in-house activities will be prepared. The approach developed will be compatible with present system development policies and will be coordinated with other personnel-oriented disciplines such as human factors engineering. In addition, methodologies and procedures for assessing and validating the effectiveness of ISD programs will be developed.

SUPPORTED BY U.S. Dept. of Defense, Naval Training Equipment Center, Human Factors Lab.

4.0012, TRANSIENT BEHAVIOR OF RADIATION AND SCATTERING FROM CONDUCTING BODIES

P.L. Uslenghi, University of Illinois, Chicago Circle Campus, School of Engineering, Dept. of Information Science, *Box 4348, Chicago, Illinois* 60680 (DF047600; AFOSR-77-3253)

AF function - wide band radar detection and EMP hardening of aerospace vehicles. Deficiency - algorithms for electromagnetic radiation and scattering under transient conditions need improvement. Objective - solutions will be sought to five problems in areas of uncertainty. How work contributes - solutions will enhance engineering understanding and thus aid design. Hopefully new design techniques may be suggested.

Solutions to the following problems in transient electromagnetic radiation and scattering will be sought and properties of interest in physical and engineering applications will be investigated. The five problems with the best understood first are transient radiation from spheroidal antennas, constraints on the singularity expansion method for early time transients, loop antennas in a dispersive environment, radiation from truncated guiding structures, and pulsed antenna array radiation pattern design techniques.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0013, TECHNIQUES FOR MICROSTRIP ANTENNA

G.T. Deschamps, University of Illinois, Urbana Champaign Campus, School of Engineering, Dept. of Electrical Engineering, 2527 *Hydrosystems Lab., Urbana, Illinois* 61801 (DF903960; F19628-78-C-0025)

AF function - weapons delivery, antenna systems for high-speed aircraft, missiles and aircraft to satellite communication. Deficiency -microstrip antennas that use more complex types of radiating elements than a simple slot or a rectangular plate have not yet been fully understood or analyzed. The objective is to

analyze microstrip antenna and radiating elements and provide manageable design formulas to allow synthesis of antenna arrays. How research contributes - provides microwave antenna engineers the techniques and tools to design flush-mounted antennas.

The radiation fields from basic canonical shapes of microstrip antennas will be investigated using techniques such as modal analysis of edge currents, Weiner-Hopf and singularity expansion methods, and the geometrical theory of diffraction (GTD). Numerical techniques may be used wherever necessary. Elemental characteristics such as frequency bandwidth, input impedance and mutual coupling effects will be analyzed and manageable formulas and design criteria determined. Antenna experiments will be performed to verify the results of the theory.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

4.0014, PHOTOVOLTAIC GASS CELL THERMAL STUDY
J.D. Bankston, Louisiana State University, University of New Orleans, School of Engineering, Dept. of Mechanical Engineering, *1542 Tulane Ave., Lake Front, New Orleans, Louisiana* 70122 (NAS 8-33479)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Marshall Space Flight Center

4.0015, THE CONTRACTOR WILL CONDUCT A THREE-DAY SYMPOSIUM ON CAREERS IN SCIENCE AND ENGINEERING AT THE MORGAN STATE UNIVERSITY
K. Jerkins, Morgan State University, Graduate School, *Hillen Rd. & Cold Spring Ln., Baltimore, Maryland* 21212 (NAS 5-25533)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

4.0016, 10-WEEK SUMMER INSTITUTE IN SCIENCE AND ENGINEERING
N.K. Proctor, Morgan State University, Graduate School, Dept. of Biology, *Hillen Rd. & Cold Spring Ln., Baltimore, Maryland* 21212 (NAS 5-25700)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

4.0017, GROUND ASSEMBLY AIDS (ADL)
P. VonThuna, Arthur D. Little Inc., *15 Acorn Park, Cambridge, Massachusetts* 02140 (DA0H4397; DAAK60 78 C 0069)

Conduct an exploratory search and study to identify and assess candidate ground assembly aids to be used by airborne personnel after an airdrop assault, even in zero to low visibility ground conditions. Available varied technology in direction-orienting finding equipment, such as homing beacons, night vision aids and RF electronics will be considered.

Contractor will visit user and other government facilities to assess problems of airborne ground assembly of personnel and technology available to solve problems. Contractor will study and identify (1) short-term candidates from available technology and off-the-shelf hardware, and (2) long-term, more cost-effective and optimum systems for future development.

SUPPORTED BY U.S. Dept. of Defense, Army, Natick Research & Development Command

4.0018, ENERGY CONVERSION - STUDIES OF TRANSONIC TURBINES WITH FILM-COOLED BLADES
J.F. Louis, Massachusetts Inst. of Technology, Div. of Sponsored Research, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (DN475064; N00014-76-C-0253)

The objective of this project is to gather the necessary data essential in developing design procedures for high-performance, cooled, highly loaded transonic turbine stages. The effort is theoretical and experimental in nature and is aimed at reducing the amount of cooling required per unit of work extracted. The research will contribute to increased performance of gas turbine engines needed particularly for naval aircraft propulsion, but useful as well to marine power plants and fixed installations.

Study will be made of heat transfer and shock-film interaction in the blade passages, in optimizing performance and design of blade passages, and secondary flow injection. A linear cascade is utilized to test performance of an optimum film cooled blade row. The effort will involve the effect of injection at various angles, influence of angle of attack and the effect of unsteadiness on the pressure and heat transfer distribution around the blades.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0019, HIGH BURNOUT SILICON SCHOTTKY MIXER DIODE DEVELOPMENT
Y. Anand, Microwave Associates Inc., *Northwest Industrial Park, Burlington, Massachusetts* 01803 (DN780126; N00173-77-C-0029)

To develop X-band Schottky barrier diodes with RF burnout of 10 watts minimum to 1 microsecond pulses. To achieve RF pulse burnout of 80 watts to 3 nanosecond wide RF pulses at 9.375 GHZ.

The Ta-Pt-Ta-Au system will be evaluated for development of low barrier height and high burnout Schottky diodes. A composite Ti-Pt Schottky will be investigated using a composite Ti-Pt sputtering target in addition to a ring structure. A tripod and multidot structure will be investigated to further improve the CW burnout characteristics. Ion implantion to lower the barrier height will also be used.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

4.0020, HYBRID COMPUTING TECHNIQUES FOR TRANSONIC FLOW FIELDS
T.C. Adamson, University of Michigan, Ann Arbor Campus, School of Engineering, Dept. of Aerospace Engineering, *Ann Arbor, Michigan* 48104 (DF052910; AFOSR-78-3635)

AF function - advanced propulsion and aerospace vehicle systems. Opportunity - improvement of present semi-numerical methods for solving transonic flow field problems. Objective - use asymptotic techniques to derive analytical solutions for use in conjunction with numerical methods. How work contributes - will improve accuracy of present solutions or reduce computing time of present methods or both.

During the present grant two problems will be investigated. These are to accurately determine shock wave position in a flow field and the use of far-field asymptotic solutions in viscous flow field computations with application to the boat tail problem. The results obtained by asymptotic methods will be tested and compared with results of purely numerical calculations obtained by Dr. W.L. Hankey's group at AFFDL.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0021, LASER LIGHT INTERACTION AND OPTICAL AND X-RAY EMISSION FROM DENSE METALLIC PLASMAS
R.S. Ong, University of Michigan, Ann Arbor Campus, School of Engineering, Dept. of Aerospace Engineering, *Ann Arbor, Michigan* 48104 (DF041670; AFOSR-76-2904)

AF function - operation of high-altitude vehicles in a post-nuclear explosion environment, development of electromagnetic weapons, space and ionospheric communications as well as countermeasures demand advanced equipment unavailable to date. Defiifiency - present-day information is inadequate to design the aforementioned equipment. Such information may be obtained from experimental and theoretical work in metallic (collisional) plasmas. Objective - this project will investigate theoretically the behavior of high-density, high-Z and moderately high temperature plasmas which are strongly dominated by collisional and partial ionization phenomena. Such plasmas are metallic plasmas produced by exploding wires. This theoretical work will be coordinated with the experimental work on exploding wires performed by Prof. Bach. Contribution - this work is a part of a comprehensive program on plasma research for the development of an X-ray radiation source for simulation of nuclear weapon ef-

fects, the development of advanced electromagnetic weapons (laser and ion beam), the development of space and ionospheric communications and the development of countermeasures.

This project will investigate the following four areas: (a) MHD plasma simulation incorporating a satisfactory radiation transport description. This radiation transport and reabsorption is very important in the study of X-ray emission of optically thick metallic plasmas. The aforementioned description will be based upon collision probability methods. (b) Collision and transport phenomena in ultra-high density plasmas will be investigated. They will use the kinetic equation they developed which characterizes fluctuations in high-density plasmas to determine transport coefficients and compare these with the Spitzer values. (c) Self-focusing and filamentation instability in the Z-pinch and exploded wire plasma will be continued with special attention to their geometry and parameters. A cylindrical symmetric beam is assumed with a Gaussian distribution along the radius. (d) Soliton-like structures in plasmas violently disturbed by an intense laser beam will also be investigated. These may be generated by a self-focusing process, parametric excitation and others. The effect of the exponential nonlinearity in the Schroedinger equation regarding the collapse of Langmuir waves will be studied. (Text abridged.)

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0022, A STUDY OF SOME ELECTROMAGNETIC PROBLEMS RELATED TO EMP TECHNOLOGY

C.T. Tai, University of Michigan, Ann Arbor Campus, School of Engineering, Dept. of Electrical Engin, *Ann Arbor, Michigan* 48104 (DF050240; AFOSR-77-3465)

AF function - electromagnetic sensors for aircraft are affected by structure on which they are mounted. This study seeks to quantitatively investigate the effect of the mounting structure on the sensor. Opportunity - the results of this study will provide important information essential in the design of aircraft antennae. Objective -the proposed research will elucidate the role of the singularity expansion method in the development of equivalent circuits for antennae and scatterers. Contribution - this investigation will provide a quantitative assessment of the effect of mounting structures on nearby sensors.

The study of equivalent circuits for antennae and scatterers will be approached as follows - (1) An investigation of the role of the entire function in the singularity expansion of the response function. (2) Obtain the complex natural oscillation frequencies of sections of loss-less and lossy uniform and non-uniform transmission lines terminated by known impedances. (3) Develop SEM equivalent circuits for cylindrical antennae and scatterers from their frequency domain responses. (4) Obtain experimentally appropriate frequency domain results for a conducting sphere, and (5) Develop SEM equivalent circuits for simplified aircraft models from their available frequency domain results.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0023, INHERENT ERRORS IN ASYNCHRONOUS DIGITAL FLIGHT CONTROLS

C.R. Slivinsky, University of Missouri, Columbia Campus, School of Engineering, Dept. of Electrical Engin, *103 Engineering, Columbia, Missouri* 65201 (DF043050; AFOSR-76-2968)

AF function - analyses of monitoring algorithms for detecting failures in Air Force flight control systems. Deficiency - in order to achieve required reliability, redundant computers are used to control critical loops in flight control systems. The techniques used to detect failures in any of the multi-computer loops has not been satisfactorily investigated. Objective - the objectives of this research are to devise, model, and evaluate alternative algorithms for monitoring and voting in asyncronous, redundant flight-control systems. How work contributes -success in the area of research will facilitate the entry of modern digital control systems into the active Air Force inventory.

Research will be in three areas. First, new algorithms will be devised for monitoring/voting operations. Finally, the monitoring/voting algorithms will be evaluated through the use of large-scale, real-time laboratory simulations.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0024, CORRELATION AND PREDICTION OF SIGNAL GROUP TIME DELAYS AT CLOSELY AND MODERATELY SEPARATED LOCATIONS

H. Soicher, U.S. Dept. of Defense, Army, Communications Research & Development Command, Center for Communications Systems, *Fort Monmouth, Red Bank, New Jersey* 07703 (DA0F2871)

Accuracy requirements of satellite communication and navigation systems have focused attention on the effects of ionization along the propagation path. To meet accuracy requirements at least cost, ionospheric effects on signal group delay will have to be predicted and transmitted to the user for corrections. Previous ILIR projects have shown that excellent correlation exists between total electron contents (TEC) (or equivalently time delay variations) at two stations along the same longitude (but separated by equivalently 13 degrees in latitude), as well as at two stations separated by equivalently 20 degrees in longitude and equivalently 35 degrees in latitude. In trying to predict TEC at one location based on equivalent data in the other, the results yielded accuracy to within one standard deviation in the former case (i.e. same longitude stations) but to within 2 standard deviation in the latter case. The objective of this following study is to extend the analysis to closely-separated (Fort Monmouth, NJ, Hamilton, MA) stations and moderately separated stations (Fort Monmouth, NJ, WSMR, NM). The study will establish the extent of correlation area within which TEC may be predicted at one station with acceptable accuracy from known TEC variation at another location.

Correlation coefficients (based on linear regression analysis) will be computed for time delay data (or TEC) at Fort Monmouth, NJ, and WSMR, NM, and at Fort Monmouth, NJ, and Hamilton, MA. Average regression lines obtained by the analysis will then be used to try to determine TEC at WSMR, NM, and Hamilton, MA, assuming the availability of data at Fort Monmouth. The study will be done for different months of the year to examine possible seasonal variation.

SUPPORTED BY U.S. Dept. of Defense, Communications Research & Development Command, Center for Communications Systems

4.0025, ADVANCED REMOTELY PILOTED VEHICLE AVIONICS SUPPORT

J.E. Bauer, U.S. Dept. of Defense, Navy, Naval Air Engineering Center, Ground Support Equipment Dept., *Lakehurst, New Jersey* 08733 (DN896002)

Develop support concepts and techniques for RPV avionics based on the determination of advanced RPV avionic characteristics.

Conduct studies to determine potential applications of RPV avionic systems, including operating environments, support requirements and physical and electrical characteristics. Analyze technology pertinent to RPV avionics support and determine new techniques to carry out the support function.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

4.0026, COMMUNICATIONS - PHYSICAL EFFECTS AT INTERFACES IN MICROWAVE DEVICES

L.F. Eastman, Cornell University, Ithaca Campus, School of Electrical Engineering, Dept. of Electrical Engin, *Ithaca, New York* 14850 (DN575176; N00014-75-C-0739)

Future developments and improvements in solid-state microwave devices for Navy systems will result from better understanding of how material properties affect device operation. Thin-film electron devices are very sensitive to processes which occur at interfaces between two solid materials. This research will study parameters which affect the performance of microwave devices in gallium arsenide and alloy III-V semiconductors.

Extremely high purity films of the III-V ternary and quaternary alloy compound semiconductors are grown on gallium arsenide and indium phosphide substrates. High-resistivity buffer layers of

chromium-doped gallium arsenide will also be used. These structures will be formed in studies to reduce noise properties in FET devices and to reduce shunt conductance through the substrate. All efforts will be directed toward achieving lattice matched conditions for all heterojunctions grown by liquid phase epitaxy (LPE) and to minimize the transition layer between film and substrate. These junctions will be studied using SIMS profiling analyses and by transient spectroscopy.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0027, A STUDY TO ASSESS THE POTENTIAL FOR USING LONG-CHAIN POLYMERS DISSOLVED IN WATER TO STUDY TURBULENCE

J.L. Lumley, Cornell University, Ithaca Campus, School of Engineering, Dept. of Mechanical & Aerospace Engineering, *242 Carpenter Hall, Ithaca, New York* 14853 (NSG 2382)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

4.0028, ANALYTICAL INVESTIGATION OF MULTINOZZLE PLUME FLOW FIELDS

S. Rudman, Grumman Corp., Grumman Aerospace Corp, *S. Oyster Bay Rd., Bethpage, New York* 11714 (DF042270; F44620-76-C-0021)

AF function - offensive and defensive sensors rely upon predicted plume observables for tracking enemy missiles. Deficiency - current prediction techniques rely upon an inaccurate equivalent single engine concept in estimating the observables from multiple nozzle plumes. Objective - the prediction of the flow field on multiple nozzle systems by analytic study and numerical calculation to determine the effect of the impingement of the individual plumes on each other. How work contributes - allows the design of more accurate missiles and more reliable intelligence satellites.

A numerical technique is devised to compute the inviscid flow pattern associated with twin-nozzle plume flow fields. The technique involves the solution of the supersonic Euler equations by a forward marching technique. Shock waves and plume boundaries are treated as discontinuities which are free to float between the computational grid network. The subsonic portion of the flow field behind Mach discs is handled by an iterative technique.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0029, TRANSONIC WING-BODY CALCULATIONS

A. Jameson, New York University, Courant Inst. of Mathematical Sciences, *251 Mercer St., New York, New York* 10012 (DN775079; N00014-77-C-0032)

The development of accurate methods for the prediction of the transonic flow fields about complex aircraft and missile configurations is essential for their design and optimization. The proposed research will develop finite-difference techniques for solving the complete potential equation for the transonic flow about three-dimensional configurations.

The development of accurate predictive techniques for increasingly complex configurations is an evolutionary one. The planned research will examine methods capable of extending the previous wing work of Jameson and Caughey to include the added complexity of a fuselage. The investigation will be conducted within the framework of the complete potential equation. The major effort will be devoted to the development of differencing procedures in conservation form.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0030, ASYMMETRIC BOUNDARY LAYER TRANSITION ON BALLISTIC REENTRY VEHICLES

R. VaglioLaurin, New York University, School of Science & Engineering, Dept. of Aeronautics & Astronautics, *Washington Sq., New York, New York* 10003 (DF048560; AFOSR-77-3359)

AF function - aerospace vehicles. Opportunity - to develop a deeper understanding of the mechanisms controlling hypersonic boundary layer transition over slender reentry vehicles. Objective - to ultimately evolve a rational, efficient, and reliable hypersonic boundary layer transition prediction/design methodology. How work contributes - this study will identify the effects of environmental and material characteristics on the hypersonic boundary layer transition process over pointed and/or slightly blunted slender cones such as are employed in advanced reentry vehicles.

A theoretical investigation using forced response-stability modeling of the boundary layer transition process will be made with specific emphasis given to such influences as environmental perturbations, angle of attack and material interactions. Validation of the analyses will be made against laboratory and/or free flight data wherever possible.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0031, SURFACE ACOUSTIC WAVES (SAW) SILICON MONOLITHIC PROGRAMMABLE SENSOR/PROCESSOR

S.T. Kowel, Syracuse University, L.C. Smith College of Engineering, Dept. of Electrical & Computer Engineering, *Link Hall, Syracuse, New York* 13210 (NSG 1611)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

4.0032, ADVANCED PROGRAMMABLE IMAGE SENSOR/PROCESSOR

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SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

4.0033, QM-1 VIRTUAL MACHINE MONITOR

E.C. Stanke, U.S. Dept. of Defense, Air Force, Rome Air Development Center, *Griffiss Air Force Base, Rome, New York* 13441 (DF916090)

The objective of this project is to implement a virtual machine monitor (VMM) for the multi machine on the QM-1. This involves two basic aspects. The first is the task of making the multi machine a virtual machine. This task will aid in clearly defining the requirements for any machine to allow it to be virtualized. The second task is the design and implementation of a virtual machine monitor (VMM) for the multi machine which will allow the simultaneous operation of more than one multi machine on the QM-1 at one time. This will be demonstrated by the running of two different systems on the QM-1 at the same time.

This is to be an in-house project, using the resources in hand. These resources include manpower from the ISCA section and the Nanodata QM-1 microprogrammable computer. Some additional consultation concerning virtual machines will be required for ISI. The amount of ISI manpower required for this consultation is negligible. There are eight basic tasks in this project as outlined below: 4.1 tasks - 4.1.1. Study literature, 4.1.2. Analyze ALM VMM (multics VMM), 4.1.3. Describe functional requirements for VMM for multi, 4.1.4. Design multi VMM, 4.1.5. Implement multi VMM, 4.1.6. Analyze multi regarding virtualizability, 4.1.7. Modify multi nancode to make it a virtual machine, 4.1.8. Demonstrate multi VMM.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

4.0034, ND-SOAP MINI LASER TARGET DESIGNATOR

M.M. Heil, U.S. Dept. of Defense, Air Force, Avionics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF097370)

To provide a technology for development of simple, efficient, high-radiance target designators for long-range laser-aided weapon delivery systems. A secondary objective will be to reduce countermeasure vulnerability due to the wavelength separation of Nd-SOAP relative to Nd-YAG.

This program will combine two new technologies. These are the mini-face pumped laser (FPL), a thermal-optic distortion reduction laser configuration, and an increased energy storage laser material, Nd-SOAP. The use of an increased energy storage material will allow attaining 500-1000 millijoules in a single oscillator. However, the thermal optic distortion of Nd-SOAP in round rod form will not allow near diffraction limited performance. Thus it is planned to design and build a Nd-SOAP target designator in the mini-FPL configuration. It is anticipated that material will be available in a size to allow operation at 500 millijoules per pulse and 10-20 pps. The residual thermal-optic distortion will be studied. Another important area of investigation will be mode control techniques to allow efficient use of the slab volume in low-order mode operation.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Avionics Lab.

4.0035, ENERGY METHODS IN THE EXTREMIZATION OF FLIGHT PATH TRAJECTORIES

G.W. Francis, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF142240)

This work unit supports advanced aerospace vehicles. The objective of this study is to define methods by which a class of flight path optimization problems may be solved in a simplified procedure. The method and procedures defined will be applicable to the classical performance problems as well as other problems such as tracking and air-to-air maneuvering. The results of this study will lead to a method by which simplified algorithms may be developed for airborne computer use. the development of the actual algorithms will be a following 6.2 effort.

The approach will be to use the energy model of the aircraft dynamics and apply modern optimization techniques to obtain solutions to a class of problems. Theories of controllability and observability will be applied to define the boundaries of the solution and determine the existence of extrema. There have been some contradictory results in the literature in this area. This effort will investigate this problem in-depth.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

4.0036, RESEARCH IN STABILITY AND PERFORMANCE OF MISSILES

F.M. Sawyer, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF140600)

This work unit supports TPO 3, flight control, and major thrust FG02, to develop, improve and maintain a current baseline of flight control design techniques and application criteria. The aerodynamic forces and moments acting on a missile performing a general pitching, yawing, and rolling motion are not fully understood. It is the objective of this research to increase the understanding of the aerodynamics of missile motion and to provide aerodynamic data which will aid in optimizing the design and performance of missile systems.

The approach is to conduct and sponsor theoretical, analytical, and experimental research on aerodynamics stability problems associated with air-launched and entry missiles. Emphasis will be directed toward the development and utilization of dynamic wind tunnel testing techniques, analysis of flight data, and theoretical prediction of aerodynamic stability coefficients.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

4.0037, BOUNDARY LAYER TRANSITION ON STRATEGIC MISSILES

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The accuracy and weight of strategic missiles are influenced by the state of the boundary layer on the surface of the reentry vehicle. This results from the direct dependence of aerodynamic heating on the nature of the boundary layer and impacts on the selection of the material, the determination of the thickness of the thermal protection system, and the vehicle shape change due to ablation. The objective of this investigation is to improve the technology base in the area of boundary-layer transition, giving emphasis to nose-tip transition and asymmetric frustum transition. This will lead to improved design criteria to minimize weight, hence reduce cost, and improve weapon performance.

An experimental investigation of boundary-layer transition is to be conducted in the AFFDL Mach 6 wind tunnel. The approach is to establish transition trends which will help the vehicle designer minimize the undesirable concave nose-tip ablation shapes and asymmetric frustum transition.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

4.0038, RESEARCH ON DESIGN ANALYSIS FOR DUAL MODE AIR LAUNCHED MISSILE SYSTEM (SUMMER FACULTY PROGRAM)

J.D. Pinson, University of Dayton, School of Engineering, Dept. of Mechanical Engineering, *300 College Park Ave., Dayton, Ohio* 45469 (DF050540; F49620-78-C-0011)

AF function - weapons delivery, aerospace vehicles. Opportunity -incorporate state-of-the-art technology into an Air Force weapon system of enhanced mission effectivenss. Objective - to conduct a systems analysis and design study of a dual mode air launched missile system for bomber aircraft, to promote awareness of Air Force technological problems among the engineering faculties of universities. How work contributes - the work will form the foundation for weapon system design choices by the Aeronautical Systems Division, including technical feasibility, adequacy of available technology, mission effectiveness, operational feasibility. It will establish increased awareness of Air Force technological problems leading to possible future research contributions to the Air Force by engineering faculty members.

A university summer faculty design project will be conducted by the contractor at Wright-Patterson AFB/ASD, with cooperation of AFWAL and aerospace industry. In cooperation with the American Society for Engineering Education, 12 faculty members will be selected, after nation-wide advertisement, to participate in a 10-week intensive design effort. A senior investigator design engineer will be in immediate charge of the study. A 5-member technical steering committee of well-recognized experts will advise the program director and evaluate the work of the study. A final report will be submitted to the Air Force giving the full results obtained.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0039, DESIGN AND FABRICATION OF A SIMULATED REMOTE ACQUISITION UNIT FOR SPACELAB EXPERIMENTS

C.A. Mason, Pennsylvania State University, University Park Campus, Graduate School, *205 Kern Graduate Bldg., University Park, Pennsylvania* 16802 (NAS 9-15798)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Johnson Space Center

4.0040, THREAT SIMULATION WITH RADAR TARGET AUXILIARY SYSTEM RTAS

D. Ottaviano, U.S. Dept. of Defense, Navy, Naval Air Development Center, Air Vehicle Technology Dept., *Warminster, Pennsylvania* 18974 (DN762121)

The objective is to evaluate the effectiveness of weapons computer models against threat radar signatures that include glint, amplitude scintillation and jet engine modulation. The model responses will provide analytical techniques and figures of merit for target radar augmentation development.

This task will undertake the following: 1. Determine which weapon seeker computer models are available. 2. Determine how the target radar signature is used in these models. 3. Determine the method to incorporate the target radar signature that includes the scintillation characteristics as an input to these models. 4. Study the effects of scintillation on missile performance using the computer model. 5. Compare the effectiveness of current RTAS devices. 6. Determine the degree of radar signature fidelity required in augmentation for the various weapon seekers and for

RDT&E as well as for training environments. 7. Supplement these findings with additional target/threat signature measurements. 8. Initiate hardware development to simulate advanced parameters.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

4.0041, SCIENCE OF FRACTURE

M.L. Williams, University of Pittsburgh, School of Engineering, Dept. of Engineering, *402 Engineering Hall, Pittsburgh, Pennsylvania* 15213 (DF053120; F49620-78-C-0101)

AF function - improved durability and reliability of aerospace flight vehicles is of major importance to insure flight safety and reduce life cycle costs. Deficiency - the basic understanding of the fracture of structural material that exists is inadequate to meet desired Air Force capabilities. Objective - to understand the basic mechanisms of fracture and the associated structure-property relationships of structural materials. How work contributes - research results will directly contribute to the improved performance of flight structural systems.

This research project is organized into four basic research areas and two areas of technology integration and assessment. Research will be investigating: 1) analytical efforts and basic mechanisms, 2) structure-property relationships, 3) numerical analysis methods, and 4) instrumentation science. Areas one and two will receive major emphasis during the first two years of this program. These topics will focus on the science of fracture for metals, polymers and ceramics. The remaining research areas will be funded at a much lower level and will increase as a consequence of the natural progress of the research. The areas of technology integration and assessment will also be funded at a low level. The purpose of these areas is to engage in an active process of technology integration with development programs and applications. This activity will insure the rapid use of research results and the identification of critical issues dealing with fracture processes.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0042, LV STORE INVESTIGATION

F.L. Heltsley, Arnold Research Org. Inc., *Arnold Air Force Base, Tullahoma, Tennessee* 37389 (DF421023; F40600-77-C-0003)

Using a laser velocimeter, a wind tunnel test will be conducted to measure the flow field velocities surrounding a store model in a transonic flow field. Measurements will be completed first for the store model in an interference-free environment and then for the store model in the presence of flow interference from a wing or from additional stores.

The flow field velocities measurements will be used to validate a theoretical prediction scheme for predicting velocities in the region surrounding aircraft external store configurations.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Arnold Engineering Development Center

4.0043, FREE STREAM DATA COLLECTION

V.S. Oxford, U.S. Dept. of Defense, Air Force, Arnold Engineering Development Center, *Arnold Air Force Station, Tullahoma, Tennessee* 37389 (DF641560)

Air Force function - aircraft-stores compatibility. Opportunity -structural integrity and certification of stores on aircraft. Goal - to provide store free stream aerodynamic data in graphical, tabular, and magnetic tape form. How work contributes - allows for a quick and efficient means of obtaining data for use with MIL-A-8591E and for comparisons with stores in carriage.

The approach will be to first compile the existing available store free stream aerodynamic data, and then develop a data retrieval system which allows for access to the data through tabular, graphical, or magnetic tape form. The system will be updated to include new data as it becomes available.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Armament Lab.

4.0044, NEW MEMORY DEVICE STRUCTURES

G.A. Hartsell, Texas Instruments Inc., *13500 N. Central Expy., P.O. Box 5621, Dallas, Texas* 75222 (DF096850; F33615-74-C-1054)

In Mar 76, Samso/SZS added funding to this contract which would be used to fabricate and test CCD signal processing circuits for a scanning focal plane application. The objective was to determine whether the radiation hard CCD structure, tested previously on other program tasks, could be adapted to perform a useful device function for space applications.

In order to assess the potential of the radiation hard CCD structure for space applications, a composite test device will be fabricated and evaluated in a simulated focal plane operation. The composite test device will simulate a 3-line IR sensor and will extract the x-y coordinates of a point object in its FOV, as well as discriminating betweeen true signals and gamma-induced noise.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Avionics Lab.

4.0045, QUASI-OPTICAL TECHNIQUES FOR MILLIMETER AND SUBMILLIMETER WAVE CIRCUITS 16171-EL

T. Itoh, University of Texas, Austin Campus, School of Engineering, Dept. of Electrical Engineering, *200 W. 21st, Austin, Texas* 78712 (DA0F9259; DAAG29-78-G-0145)

To investigate both theoretically and experimentally a class of dielectric transmission lines suitable for millimeter and submillimeter wave components and integrated circuits. Relevance - results of the study are directly relevant to Army systems requiring low-cost, reproducible millimeter wave components. Reviewers from MIRADCOM and ECOM mention applications to missile sensors and terminal guidance, radar for mini-remotely piloted vehicles and communications.

To utilize surface wave propagation guided on the interface between a dielectric slab and a dielectric strip as a building block for millimeter wave integrated circuits. Particular emphasis will be placed on the utilization of grating structures within the guiding region to obtain (1) leaky-wave antennas and (2) high-Q band-pass and band-reject filters.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0046, BASIC RESEARCH IN ELECTRONICS (JSEP)

E.J. Powers, University of Texas, Austin Campus, School of Engineering, Dept. of Electrical Engin, *200 W. 21st, Austin, Texas* 78712 (DF015240; F49620-77-C-0101)

AF function - electronic research is essential to all Air Force missions and functions, expecially aerospace reconnaissance, communications, surveillance, navigation, command and control of operating forces, and gathering, processing, and transmission of intelligence and information. Technology for all of these functions requires lower cost, components, networks and systems. Opportunity -continued research on properties of electronic materials, circuits, and systems supports this technology. Objective - the Joint Services Electronics Program (JSEP) provides the research baseline in the electronic sciences for all three military services. How work contributes - jointly and equally supported and managed by the Air Force, Army, and Navy, it provides the DOD with a hard-core electronic research capability which includes a highly flexible, quick response to new research opportunities over a broad area of electronic science and engineering.

This part of the JSEP effort addresses itself to theoretical and experimental research in solid-state materials and devices in essentially two directions which focus on solid-solid surface reactions and instabilities and transport at surfaces of solids. This part of the JSEP effort addresses itself to theoretical work in large-scale system theory, nonlinear estimation, software engineering and reliable digital circuit design.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0047, ENERGY INPUT TO THE AURORAL IONOSPHERE

J.R. Doupnik, Utah Higher Education System, Utah State University, School of Engineering, Dept. of Applied Physics & Info Science, *Office in Engineering, Room L50, Logan, Utah* 84321 (DF049930; AFOSR-77-3435)

AF function - many radio and radar communications and surveillance systems depend upon trans-ionospheric paths or upon refraction or reflection by the ionosphere. A number of surveillance systems also see ionospheric emissions (mostly in the IR) as noise. Energy depositions in the ionosphere change its signal management and emission characteristics. Opportunity - the investigators will use a unique ionospheric diagnostic tool, the incoherent scatter radar, at Chatanika, Alaska, and could derive support from an AF geophysics laboratory rocket program scheduled at the same time. Objective - to perform a field experiment to determine the relative importance of particle precipitation and joules heating in the auroral ionosphere and to determine the ionospheric response to that heating. Also to support AFGL rocket program. How work contributes - an understanding of the partition of energy deposition and ionospheric response will permit an increase in the sophistication of ionospheric models necessary for communication/surveillance management.

The Chatanika radar will be used to monitor energy depositions. A detailed investigation of these areas where deposition occurs.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0048, STUDY OF RADIATIVE SCATTERING CONCEPT OF PLUME INFRARED RADIATION OBSCURATION

R.D. Harris, Utah Higher Education System, Utah State University, School of Engineering, Dept. of Electrical Engin, *Office in Engineering, Room L50, Logan, Utah* 84321 (DF049670; F49620-77-C-0121)

AF function - this proposed research primarily falls in the 5.2 research objectives which deal with the reduction of detectability of aircraft exhaust plumes. The goals are to reduce the IR radiation by 95 percent and to obtain better spectral models for the IR radiation of exhaust gas constituents, and to determine the influence of additives, including the effect of minor chemical species and aerosols on modifying the electron concentration and the visible and IR radiation patterns. Deficiency - realistic models of the jet exhaust plume, including the effect of putting aerosols around the plume, are needed in order to reduce the detectability of aircraft in a hostile environment. Work is needed both from experimental and theoretical sides so that reasonable progress can be made in this area. Objective - the technique that is proposed is to employ an aerosol suspension of solid particles or liquid drops which will increase the scattering path length thus enhancing the potential for photon absorption. An experimental study is proposed to evaluate this absorption scattering concept for carbon particles and for liquid aerosols and to select candidate materials for system applications. A theoretical program is also proposed to develop a numerical code to calculate the radiative transfer for a plume/shroud geometry. Contribution - this is one of three proposals to look into this area. This is a joint AFAL and AFOSR project.

Work will be performed by Utah State Univ. and the chemistry and physics lab. of the Aerospace Corporation to find gas vapors which possess absorption features at the primary infrared wavelengths emitted by jet aircraft plumes. Vapors such as N2O and methy-lisothiocyanate for the 4.6 microns CO2 band wing and formic acid for the 2.9 microns H2O/CO2 band wing have proved effective in the obscuration of the infrared radiation. Preliminary estimates of the amounts of these materials required to form a shroud around a typical aircraft plume to provide 90 percent reduction of the intensity for a period of about 10 second indicate the concept is feasible but possibly marginal. The relative simplicity of this obscuration concept indicates that efforts should be made to increase its effectiveness. The technique that is proposed is to employ an aerosol suspension of solid particles or liquid drops which will increase the scattering path length thus enhancing the potential for photon absorption. (Text abridged.)

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0049, FREE STREAM DISTURBANCES, CONTINUOUS EIGENFUNCTION BOUNDARY LAYER IN STABILITY AND TRANSITION

C.E. Grosch, Old Dominion University, Inst. of Oceanography, *5201 Hampton Blvd., Norfolk, Virginia* 23508 (NSG 1618)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

4.0050, SOLID ROCKET MOTOR EXHAUST ABLATION RESEARCH

L.P. Anderson, U.S. Dept. of Defense, Navy, Naval Surface Weapons Center, *Dahlgren, Virginia* 22448 (DN884049)

To develop analytical research methods for predicting the effects of solid propellant rocket motor exhaust on ablative materials. This work includes developing a mathematical model to calculate time dependent exhaust flow fields from present and future solid propellant rocket motors, and the development of a theoretical method to analyze the coupled thermal ablation and particle erosion caused by the exhaust environments of these rocket motors.

A two-dimensional, time-dependent hydrodynamic code will be extended to include the effect of two-phase flow and equilibrium chemistry. The results of the flow field calculations will be used as input to thermochemical and particle erosion computations. An existing thermochemical ablation code will be modified to include particle erosion resulting from a solid rocket motor exhaust impingement. Results will be compared with available experimental data for similar conditions.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Surface Weapons Center

4.0051, STUDY OF THE TRELLIS PHASE CODES FOR IMPROVED POWER/BANDWIDTH EFFICIENCY IN SATELLITE COMMUNICATIONS

S.G. Wilson, University of Virginia, Graduate School, *Garrett Hall, Charlottesville, Virginia* 22903 (NAS 5-25634)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

4.0052, AUTOMATED MOTOR SKILLS TRAINING OPTIMIZED FOR INDIVIDUAL DIFFERENCES

R.C. Williges, Virginia Polytechnic Inst. & State University, School of Engineering, Dept. of Industrial Engineering & Operations Research, *Blacksburg, Virginia* 24061 (DF046460; AFOSR-77-3161)

AF function - this research supports all AF flight and technical training programs, especially those in which computer-based instructional systems are used, such as flight simulation. Deficiency -many factors about how a student learns are still unknown, and instructional systems which are designed for complicated flight and technical training are less efficient because of this. One major factor is individual differences in learning style, experience, and learning rates. If these individual differences could be reliably detected among learners and attended to by an adaptive, individualized instructional system, a more efficient training system might result. Objective - the objective of this research program is to investigate procedures for providing computer-adaptive motor skills training which is optimized for student individual differences. How research contributes - this research will produce models of adaptive instructional systems which will accommodate individual learner differences. The relative efficiency of these systems over conventional systems will be determined as part of the research.

A two-pronged research program plan is proposed to investigate several of the fundamental research issues underlying the use of automated procedures in motor skills training. These issues deal with individual differences in motor skills acquisition and the investigation of parameters of adaptive training systems. Experimental investigation of these two issues is needed before direct applications and optimizations of automated motor skills training procedures can be made to Air Force operational synthetic flying training devices.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0053, TRANSONIC VEHICLE DESIGN - THEORETICAL STUDIES OF TRANSONIC FAR-FIELD AND NEAR-FIELD MATCHING

W.C. Chin, Boeing Co., Commercial Airplane Group, *7555 E. Marginal Way S., Seattle, Washington* 98124 (DN675586; N00014-78-C-0349)

The development of accurate methods for predicting the transonic flow field about complex naval aircraft and missiles is essential for their design and optimization. The proposed research will explore new methods for matching analytical far fields with numerical near fields to describe the inviscid flow about complex configurations.

In the computation of transonic flow fields about bodies by numerical means, the calculation region must be finite and limited to extent, yet the field of interest is usually infinite. If coordinate transformations are not convenient, such as in complex three-dimensional flows, or if the size of the numerical field must be restricted because of the magnitude of the computations, a common procedure has been to match a numerical near field calculation to an analytical far field. The closer the matching contour the greater the savings in computation. The proposed research will examine matching in which continuity of both the velocity potential and its normal derivative are preserved as well as the use of higher order far field solutions.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0054, NAVY VEHICLE DESIGN AND CONSTRUCTION - FINITE VOLUME METHODS FOR THREE-DIMENSIONAL TRANSONIC FLOW

E. Murman, Flow Industires Inc., *21414 68th Ave. S., Kent, Washington* 98031 (DN875175; N00014-78-C-0079)

Accurate prediction of three-dimensional flows about wings and bodies is essential for the design of cost-effective and high-performance military aircraft. Recent developments in numerical finite volume methods have led to the potential capability of computing such flows in the complex transonic regime for realistic aircraft wing/body shapes. It is the objective of this investigation to develop this potential into a useful and effective analysis tool for use in aerodynamic research and design.

A preliminary wing/body program will be developed using a finite volume method to solve the full potential equations for a wing and a closed body with a noncircular fuselage in transonic flow. New mesh systems and mapping procedures that are under development in basic research programs will be incorporated in the program. Aerodynamic forces and moments for example cases will be computed to assess the accuracy of the method.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0055, DIGITAL SYSTEM THEORY

J.S. Meditch, University of Washington, School of Engineering, Dept. of Electrical Engin, *206 Guggenheim Hall, Seattle, Washington* 98105 (DF051570; AFOSR-78-3546)

AF function - design of Air Force digital control systems. Deficiency - uncertainties in the control system input cause degraded system performance. Objective - the objective of this research program is to develop better methods for handling digital control systems through the use of inverse systems. How work contributes - success in this research effort could provide effective and efficient algorithms for handling uncertain systems.

The research program will focus on the problem areas of (1) vector delay inverses, (2) pseudo inverses, and (3) inverses, observers, and feedback control. The concept of vector delay inverses is completely new and encompasses all previous work on system inverses as special cases. The theory of pseudo inverses handles situations where vector delay inverses do not exist by providing suitable approximate inverses. The objectives of the research in the problem areas (1) and (2) are the development of necessary and sufficient conditions for the existence of such inverses, and the formulation of efficient algorithms for their implementation. The combination of system inverses with observers in area (3) will provide, under conditions to be investigated in the proposed research, a structure which simultaneously determines all unknown disturbances affecting a system along with the system's state. This permits feedback control for multivariable processes without imposing restrictive, and often unrealistic, assumptions on the class of disturbances. The objective of the research in (3) is the development of a control system design theory for such cases.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0056, COORDINATED SATELLITE ROCKET AND INCOHERENT SCATTER OBSERVATIONS

P. Lagos, Universidad Particular Peruana Cayetano Heredia, *Lima, Peru* (NSG 7524)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Org. & Management, Office of University Affairs

4.0057, LONGITUDINAL VORTICES IN TURBULENT BOUNDARY LAYERS

P. Bradshaw, University of London, Imperial College of Science & Technology, *Prince Consort Rd., South Kensington, England, United Kingdom* (DN875418; N00014-78-G-0032)

The development of a fundamental understanding of the interaction of vortices and turbulent boundary layers is an essential ingredient in the design and optimization of complex naval configurations. The proposed research will study, experimentally, the interaction of an imbedded isolated vortex with a turbulent boundary layer at low speeds.

An isolated vortex will be generated on a flat plate having a turbulent boundary layer approximately one inch thick. The interaction and initial decay of the vortex-boundary layer structure will be studied optically and with measurements of the mean velocity components, pressure, Reynolds stresses, and fluctuating velocity components. Sufficient measurements will be taken so that the data can be used for assessing or developing calculational procedures.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

GEOSCIENCES

Includes Geosciences (general); Earth Resources; Energy Production and Conversion; Environment Pollution; Geophysics; Meteorology and Climatology; and Oceanography. For Related Information See Also Space Sciences.

5.0001, STUDIES IN MARTIAN GEOLOGY

Unknown, Arizona State University, Graduate School, *Tempe, Arizona* 85281 (NSG 7548)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Headquarters, NASA

5.0002, SPACE SHUTTLE ENVIRONMENTAL ANALYSIS STATISTICAL MODELS

J.D. Tubbs, University of Arkansas, Fayetteville Campus, School of Arts & Sciences, Dept. of Mathematics, *Fayetteville, Arkansas* 72701 (NAS 8-33224)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Marshall Space Flight Center

5.0003, THEORETICAL STUDIES OF THE TRANSPORT AND REMOVAL PROCESSES OF SAHARA DUST

R.D. Bornstein, California State University & Colleges, San Jose State University, School of Science, Dept. of Meteorology, *Washington Sq., San Jose, California* 95192 (NCC 2-5)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

5.0004, OCEAN WAVE ANALYSIS BY SYNTHETIC APERTURE RADAR
A.M. Peterson, Stanford University, School of Engineering, Dept. of Electrical Engin, *Stanford, California* 94305 (DN875102; N00014-78eC-0046)

Synthetic aperture radars (SAR) will be flown on satellites (SEASAT), giving wide-area, detailed surface imagery. The interaction between microwave SAR and the moving sea surface wave field is not well understood. This program will develop methods for interpreting SAR data returns in terms of actual surface wave field, by modeling actual SAR and surface wave observations.

Aircraft SAR imagery was gathered during simultaneous ocean surface measurements off the west coast of the U.S. in 1977. These data will be analyzed and used to test a mathematical ocean wave - microwave back-scattering model. The results will be used to develop a comprehensive wave-wave interaction theory which, in turn, may enable an understanding of sea wave physical processes.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

5.0005, SOIL MOISTURE DETECTION USING SEASAT DATA AND RADAR SCATTEROMETERS
J.E. Estes, University of California, Santa Barbara Campus, School of Letters & Science, Dept. of Geography, *Santa Barbara, California* 93106 (NCC 5-5)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0006, REMOTE SENSING OF PHYTOPLANKTON - A FIELD AND LABORATORY STUDY IN SUPPORT OF CZCS
D.A. Keiffer, University of Southern California, School of Letters Arts & Sciences, Dept. of Biological Science, *3551 University Ave., Los Angeles, California* 90007 (7-717; 04-7-158-44123)

OBJECTIVE: (1) To investigate the quantitative relationship between bacteria and colloids in the ocean and the spectral characteristics (color variations) of the water as seen from a spacecraft; and (2) to provide ship and scientific technical support during the Nimbus G/CZCS (Coastal Zone Color Scanner) post-launch experiment in February-March 1979.

APPROACH: (1) Current laboratory investigations into the relationship between changes in the diffuse spectral reflectance of the ocean and the presence of particles less than 1.0 micron in diameter (marine bacteria and colloids) will be extended by the use of reflectance spectroscopy. Specifically, the absorption and backscattering coefficients for common marine bacteria and isolated marine colloids will be determined from samples of southern California coastal waters. The bacteria will be concentrated using differential filtration techniques, whereas the colloids will be concentrated by ultra-filtration methods. (2) University of Southern California will provide a 110-foot research vessel, the R/V Velero IV, together with scientific/technical personnel, to conduct a 20-day cruise of southern California coastal waters. The measurements to be made, which include chlorophyll a and phaeophytin a concentration, sea temperature, and phytoplankton nutrients, are not only to provide surface truth during Nimbus G/GZCS overflights, but are to be used to extend the utility of the satellite data to times and places where surface truth is lacking. NESS scientists will be aboard to collect concurrent optical and particle size distribution data.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., National Environmental Satellite Service

5.0007, RESEARCH METHODS TO EXTRACT CLIMATE DIAGNOSTIC RECORDS FROM GEOSYNCHRONOUS SATELLITE DATA
T.H. VonderHaar, Colorado State University, School of Engineering, Dept. of Atmospheric Sciences, *Fort Collins, Colorado* 80523 (ATM7807148)

Radiation budget measurements are important for long-range weather and climate forecasting because they yield fundamental data related to the energy transport of the atmosphere and ocean. There have been many experiments to make these measurements by satellite over the last fifteen years. They have all suffered because of poor diurnal sampling as most satellites had sunsynchronous orbits. The geosynchronous satellites such as SMS or GEOS now provide an opportunity to take diurnal radiation measurements, but have been of limited use because of the difficulty of recording, processing and archiving the huge amounts of data transmitted by the satellites. The hardware and software needed to overcome this problem are being developed at Colorado State University. A fast micro-processor driven sectorizer is being designed and built to perform regional averaging of radiation data in real time. Concurrently, software is being developed to convert the regional averages into time average reflected and emitted fluxes from the top of the atmosphere. The resulting data will be archived and made available to the scientific community.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

5.0008, EARTH NUTATION-ROTATION-CRUSTAL MOVEMENT
P.L. Bender, U.S. Dept. of Commerce, National Bureau of Standards, *325 S. Broadway, Boulder, Colorado* 80302 (2741465)

PROJECT OBJECTIVE: A. To measure the usefulness of accurate earth-moon distance measurements for determining very long standard baselines' polar motion, nutation, and variations in the earth's rotation rate. B. To investigate the complementary aspects of laser distance measurements to the moon and to the LAGEOS satellite for determining crustal movements at many points on the earth's surface.

PROJECT APPROACH: A. Range residuals from the McDonald Observatory in Texas and from other fixed lunar ranging stations as available will be analyzed, with particular attention to model deficiencies. B. The advantages of a high-mobility LAGEOS ranging station for determining crustal movements at roughly 40 sites per year will be studied, including joint operations of such a station with the University of Texas transportable lunar/LAGEOS ranging station.

PRIOR YEAR ACCOMPLISHMENTS: Lack of NASA plans for crustal movement measurements at many points before 1983 or 1984 led to a high-priority study of possible use of a simple high-mobility LAGEOS ranging station for this purpose.

SUPPORTED BY U.S. Dept. of Commerce, National Bureau of Standards

5.0009, MEASUREMENT OF HYDROFYL TEMPERATURE IN THE UPPER ATMOSPHERE
J.H. McElaney, Fairfield University, School of Arts & Sciences, Dept. of Physics, *Fairfield, Connecticut* 06433 (NCC 5-6)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0010, BALLOON MATERIAL DEVELOPMENT
G.P. Durney, I L C Industries Inc., *350 Pear St., Dover, Delaware* 19901 (DF240050; F19628-73-C-0155)

AF function - advanced balloon systems (surveillance, reconnaissance, communications, environmental research support, space equipment tests, delivery operations). Deficiency - inability to efficiently and economically evaluate strategic and tactical weapon systems and military reconnaissance, communications and satellite systems. Research - balloon materials, tether cables, instrumentation, ground handling equipment and procedures and test flights to extend payload and/or altitude capabilities. How research contributes -research aids in achieving higher altitudes with heavier payloads for long duration, economic evaluation testing of military weapons systems. Improvements in balloon system components increase system performance in areas of altitude, stability, payload weight or duration.

New materials, kevlar for example, new fabrication technique, triaxial weave for example, and various coating or laminating designs will be investigated. Various fabric characteristics will be determined by series of laboratory tests in an at-

tempt to find optimum fabric for each part of a balloon. Following this selection, a 45,000 cu ft balloon using the optimum materials will be fabricated.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0011, DATA REDUCTION TECHNIQUES FOR A PRESSURE MODULATOR RADIOMETER (PMR)
H. Liebowitz, George Washington University, School of Engineering & Applied Sciences, Dept. of Civil Mechanical & Environmental Engineering, *725 23rd St. N.W., Washington, District of Columbia* 20037 (NCC 1-1)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

5.0012, GEOPHYSICS OF DARWIN CRATER, TASMANIA, AND WOLF CREEK CRATER, AUSTRALIA - STUDY OF DARWIN CRATER ROCKS AND DARWIN GLASS (ABBREV)
R.F. Fudali, Smithsonian Institution, Mineral Sciences, *1000 Jefferson Dr. S.W., Washington, District of Columbia* 20560

A newly discovered crater in Tasmania is probably related to the previously known Darwin glass occurrences in the region. Recent dating of the Darwin glass yields a formation age of 700,000 years, identical to that of Australasian tektites. This situation appears to offer the opportunity to unequivocally settle the question of whether the tektites are terrestrial or lunar in origin. To do this it is necessary to establish an impact origin for the crater and to delineate the exact relationship between Darwin Crater and Darwin glass. To do this, comparative geophysical surveys of Darwin Crater and Wolf Creek (a known meteorite crater of similar dimensions) will be carried out. In addition, extensive comparative chemical and petrographic analyses of Darwin glass and the country rocks at Darwin Crater will be made.

SUPPORTED BY Smithsonian Institution, Office of Fellowships & Grants

5.0013, RESONANT BACKSCATTER SPECTROSCOPY
P.R. Schwartz, U.S. Dept. of Defense, Navy, Naval Research Lab., *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN880023)

To develop resonant backscatter spectroscopy technique for the detection and measurement of atmospheric constituents and to investigate related active and passive sensing techniques for applications to atmospheric and stratospheric chemistry and dynamics.

Calculate backscattered intensity and spectrum of stratospheric constituents illuminated by a radar-like transmitter and conduct experiments to determine vertical distribution of O(3), H(2)O, CO and other constituents. Investigate and compare this technique with other remote sensing methods such as passive microwave spectroscopy and with in-situ measurements. Investigate application of technique to measurement of dynamical parameters such as stratospheric wind speed and temperature.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

5.0014, APPLICATION OF SATELLITE FREEZE TECHNOLOGY TO OTHER PARTS OF THE U.S.
J.F. Gerber, State University System of Florida, University of Florida, Inst. for Food & Agricultural Sciences, *Gainesville, Florida* 32611 (NAS10-9611)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Kennedy Space Center

5.0015, INTERPRETATION AND DELINEATION OF THE EARTH'S GRAVITY FIELD
B.D. Marsh, Johns Hopkins University, School of Arts & Sciences, Dept. of Earth & Planetary Sciences, *34th & Charles Sts., Baltimore, Maryland* 21218 (NCC 5-1)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0016, THE SOURCE OF LONG WAVELENGTH CRUSTAL MAGNETIC ANOMALIES
B.D. Marsh, Johns Hopkins University, School of Arts & Sciences, Dept. of Earth & Planetary Sciences, *34th & Charles Sts., Baltimore, Maryland* 21218 (NCC 5-13)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0017, STUDY OF THE OCEAN FINE STRUCTURE
O.M. Phillips, Johns Hopkins University, School of Engineering, Dept. of Mechanics, *34th & Charles Sts., Baltimore, Maryland* 21218 (NAS 6-2993)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Wallops Flight Center

5.0018, DEVELOPMENT OF AN AUTOMATED LOW-COST WEATHER OBSERVATION SYSTEM (ALWOS)
Unknown, U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., National Weather Service, *8060 13th St., Silver Spring, Maryland* 20910 (FA78WAI-872; FA161285 (TRAIS NO.))

The NWS shall furnish or cause to be furnished all necessary qualified professional, technical and administrative personnel, and facilities and equipment, including the necessary instrumentation and test equipment, to acccomplish the work defined in FAA engineering requirement, Development of an Automated Low-Cost Weather Observation System. Additional engineering requirements may be added to this agreement by amendment.

SUPPORTED BY U.S. Dept. of Transportation, Federal Aviation Admin.

5.0019, MAGNETIC ACTIVITY DATA COLLECTION AND EVALUATION
J.F. Devane, Boston College, Chestnut Hill Campus, School of Arts & Sciences, Dept. of Geology & Geophysics, *140 Commonwealth, Chestnut Hill, Massachusetts* 02167 (DF247880; F19628-76-C-0291)

AF function - operation of systems for communications, command, control, guidance, navigation and detection. Deficiency - magnetic substorms cause degradation and false signals. Performance becomes unpredictable and maximum usable frequency drops rapidly. Objective -improvement and expansion of the data collection network for use in the specification and prediction of magnetic activity. How research contributes - any system such as AFSATCOM, or any other with a mission in the c-cubed area could be optimized if the system was provided with an accurate specification and/or prediction of magnetic activity. NORAD could anticipate critical periods for their systems and exercise options for alternatives. SAC missions aborted due to communications problems could be minimized by selection of quiet periods or be com-plan modifications.

Portions of the existing five-station data collection network will be modified and upgraded to insure maximum reliability. Instrumentation will be recalibrated as required to maintain baseline values and minimize drift. Sites for the southern network will be surveyed, shelters constructed and instruments installed and tested. System performance will be reviewed and evaluated and design changes made as required.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0020, APPLICATION OF LASER RANGING AND VERY LONG BASELINE INTERFEROMETER DATA TO A STUDY OF PLATE TECTONICS DRIVING FORCES
S.C. Solomon, Massachusetts Inst. of Technology, School of Science, Dept. of Earth & Planetary Sciences, 77 *Massachusetts Ave., Cambridge, Massachusetts* 02139 (NCC 5-14)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0021, HIGH-ENERGY PLASMA ANALYSIS

B.F. Sellers, Panametrics Inc., *221 Crescent St., Waltham, Massachusetts* 02154 (DF249030; F19628-77-C-0137)

AF function - communications and reconnaissance. Deficiency -anomalous behavior of high-altitude satellites. Research - calibrate, integrate and evaluate instrumentation to measure electron and proton fluxes in .05 - 500 kev energy range. How research contributes - this analysis will be of an instrument used in the SCATHA satellite as one of a number of sensors intended to define the particle and field environment at synchronous orbit and its effect on satellite performance. It involves the integration, calibration and testing of SCATHA satellite instruments, the in-orbit operation, and the evaluation and analysis of research data from this instrument. These data will further the understanding of the synchronous orbit plasma and the causes of spacecraft charging.

This contract will provide for the integration, calibration, evaluation, and data analysis of a high time resolution particle spectrometer aboard the SCATHA satellite. By defining on a rapid time basis the influx of energetic plasma to the SCATHA satellite, the build up of potential and charge aboard a synchronous orbit satellite will be better understood. The in-orbit operation of the experiment, in coordination with other SCATHA instruments, will relate cause and effect in spacecraft charging and help to provide design criteria so that future space systems will be resistant to spacecraft charging.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0022, DATA ANALYSIS FOR DEVELOPMENT OF NEW MODEL ATMOSPHERES

L.G. Jacchia, Smithsonian Institution, Astrophysical Observatory, *60 Garden St., Cambridge, Massachusetts* 02138 (DF581700; F19628-78-C-0126)

AF function - orbital navigation, orbital surveillance. Deficiency - ephemerides of operational satellites cannot be computed accurately due to lack of knowledge of spatial and time variations of density at critical altitudes. Objective - participation in the analysis of thermospheric data and the development of new, improved models of the neutral upper atmosphere. How research contributes - new models, which will include work done on this contract, can be recommended for use by COESA in the development of revised US standard supplements and by the NORAD Cheyenne Mountain Space Computation Center for ephemeris computations.

Analysis of satellite, rocket, and ground-based measurements of atmospheric properties will be utilized in the development of new model atmospheres. AE and S3 satellite accelerometer data and coordinated composition data will be used in the development of a model representing neutral atmosphere variations related to geomagnetic activity in the lower thermosphere. A wide range of satellite data and other correlative data will be analyzed and evaluated for the determination of atmospheric properties as part of the development of dynamic models of the structure of the upper atmosphere.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0023, MEASUREMENT OF THE NEAR UV SOLAR FLUX

D.E. Bedo, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF581270)

AF function - vehicle tracking during flight and re-entry, trajectory prediction, interception, communications. Deficiency - insufficient data on solar irradiance levels to allow accurate modeling of the photochemistry and the compositional structure of the middle atmosphere and stratosphere and to allow prediction of the response of these regions of the atmosphere to temporal changes in the solar input. Objective - the determination of precise values for the absolute spectral irradiance for radiation emitted by the full solar disk at wavelengths between 1300 and 3500 Angstroms with a spectral resolution of 0.1 Angstrom. How research contributes - provides direct measurement of the major source of energy which is input to the earth's atmosphere at non-polar latitudes. Such information is required for the development of models involving atmospheric heating, photochemical reactions and charged particle production.

Solar irradiance data are acquired from rocket-borne instrumentation. Spectrometers of the Ebert type are mounted to biaxial solar pointing controls which maintain the instrument axis on the solar vector with an accuracy of better than one arc minute. The spectrometer step-scans the spectral region of interest with at least four steps per resolution element and the step position and intensity data are continuously telemetered to the ground. Instrument recovery is routinely attempted but is not required for data return. Prior to flight all instrumentation is calibrated at AFGL using laboratory monochromators and photometric standards. Individual experiments include rocket flights of the UV spectrometer alone as well as joint flights involving both rocket and balloon instruments, the latter experiment providing differential measurements of the solar flux both above and below the stratospheric ozone layer.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0024, DEVELOPMENT OF NONLINEAR INVERSION TECHNIQUES

J.I. King, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF581040)

AF function - provide global atmospheric temperature and humidity structure for military operations. Deficiency - current thermal and moisture retrieval techniques from DMSP satellite data are defective. Objective - to develop an optimal inversion technique capable of extracting all the information regarding atmospheric structure inherent in the DMP sounder data. How research contributes - provides a method whereby all accessible information is obtained as well as discriminating against bias subjectively introduced into retrieval scheme.

Nonlinear inversion has the attractive features of objectivity (no 'first-guess', prognosis, or climatological input is needed and noise discrimination (data noise is inferred and isolated by the algorithm without smoothing requirements). Our goal will be to develop nonlinear inversion algorithms for a wide variety of function sets (splines, exponential functions, power series, etc.) from a unified point of view. Following that, a scaling theory will be developed to accommodate the non-exponential transmittances of the atmosphere.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0025, THEORY OF WARM STRATUS AND FOG DISPERSAL TECHNIQUES INVOLVING THE USE OF RADIANT ENERGY

M. Klein, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF581600)

AF function - navigation, weapons delivery, command and control. Deficiency - lack of capability to disperse stratus clouds and fog that interfere with tactical Air Force functions. Objective - to conduct theoretical evaluation of warm stratus and fog dispersal techniques involving the use of radiant energy. How development contributes -development will lead to the dispersal of stratus and fog which constrain Air Force operations.

Various techniques for dispersing warm stratus and fog will be evaluated. These techniques involve the use of radiant energy, the sources of which may be ground-based or aloft. The order of magnitude amounts of energy or materials will be calculated using relatively simple one-dimensional models. The practicability of generating the calculated amounts of energy or material will be addressed. The economic and environmental factors will also be explored.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0026, ENCODER/TIMER/DECODER DEV USING CMOS CIRCUITRY FOR STANDARDIZED BALLOON CONTROL PKG

H. Laping, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF580620)

AF function - advance balloon systems for surveillance, reconnaissance, communications, environmental research. Deficiency - the existing standard instrumentation system for balloon flight-control and data gathering functions is no longer adequate for many flights due to the ever increasing number and complexity of the scientific payload requirements. Objective - design, develop and test an improved encoder/timer/decoder, for the purpose of increasing both the reliability and flexibility of the AFGL standardized balloon flight instrumentation system. How research contributes - with a standard flight control system that has been advanced to the state-of-the-art, the current need for special control systems on a majority of balloon flights will be reduced. This will result in both dollar and manpower savings.

A 16-channel variable speed data encoder and an 18-channel command decoder incorporating a precision flight safety timer will be designed, bread-boarded and tested in-house by AFGL personnel. From the in-house design final flight models will be developed and tested under contract. The final units will be integrated into a standardized AFGL balloon flight instrument and flight tested by AFGL personnel. A technical report will be the end product of the IHWU.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0027, LINE SHAPE AND FREQUENCIES

R. Davies, University of Lowell, Graduate School, *Lowell, Massachusetts* 01854 (DF248500; F19628-77-C-0053)

AF function - surveillance programs, infrared backgrounds, target detection. Deficiency - the lack of knowledge of the line shapes and widths of atmospheric absorption lines is a serious problem in evaluating laser propagation through the atmosphere and other atmospheric problems. Information is also required on the absorption due to weak lines in the window regions of the atmospheric spectrum. Research - the objective of this research is to develop the theory of line shapes with emphasis on the far wings. This will provide information on the continuum absorption as function of broadener pressure and molecular temperature. Computational schemes will be developed to calculate transition frequencies and intensities of weak atmospheric lines. How research contributes - the results of this research will provide a theoretical and computational basis for the determination of low- and high-resolution absorption observations in the atmosphere.

Using many-body treatment develop the theory of collisional broadened line shape, with emphasis on the far wings.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0028, THE MORPHOLOGY OF STRATOSPHERIC PLANETARY WAVES

A.D. Belmont, Control Data Corp., *8100 34th Ave. S., Minneapolis, Minnesota* 55420 (DF051290; F49620-78-C-0036)

AF function - long-range forecasting of meteorology and the state of the ionosphere are required to support flight and communications systems. Deficiency - little is understood of the dynamics of the upper stratosphere and mesosphere. Yet evidence is mounting that planetary wave patterns in that region are precursors of tropospheric changes. Ionospheric/tropospheric coupling, a popular topic, also suggests some interaction with that region of interest. Objective - to determine the planetary wave patterns in the stratosphere (16-55km) during the period 4/70 to 12/76 from satellite radiance data and to diagnose their spatial and temporal variations. Coupling with other layers is not within the scope. Contribution - improved understanding of the stratosphere, aid communications, possibly aid forecasting.

Satellite radiance data will be analyzed using regression techniques and available rocketsondes to determine average temperature in their stratospheric layers eq (3-13km). These spatial and temporarily distributed data will be spectrally analyzed to determine the contributions of wave numbers 1-6.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

5.0029, NAVY ENVIRONMENT - SOLAR TERRESTRIAL RELATIONSHIPS

A.D. Belmont, Control Data Corp., Research & Advanced Design Lab, *8100 34th Ave. S., Minneapolis, Minnesota* 55420 (DN875372; N00014-78-C-0306)

For the purpose of improving and extending the naval weather forecast, the objective of this research is to study the spatial morphology of the atmospheric response to variable solar activity to determine in what way it might affect the conventional weather forecast.

As a beginning step, studies will be made of the 27 and the 13.5 day variations in zonal wind speed on a hemispheric basis at selected levels and along selected meridians at all levels up to 30 km. These levels are proposed for study because the available data span many solar cycles. The spatial morphology of the sun spot cycle in zonal wind speed will also be examined up to an altitude of 30 km.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

5.0030, COMETARY MASS SPECTROMETRY

Unknown, University of Minnesota, Minneapolis Campus, Graduate School, *322 Johnston Hall, Minneapolis, Minnesota* 55455 (NSG 7575)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Headquarters, NASA

5.0031, MICROPULSATION RESEARCH AT SIPLE, ANTARCTICA, AND ROBERVAL, QUEBEC, CANADA

L.J. Cahill, University of Minnesota, Minneapolis Campus, Space Science Center, *Morrill Hall, Minneapolis, Minnesota* 55455 (DPP7721924A01)

This is a continuation of NSF grant number DPP77-21924.

Search-coil magnetometers will continue to be operated at the geomagnetically conjugate stations at Siple, Antarctica, and Roberval, Quebec, Canada, which are ideally situated for micropulsation for exploration of the plasmapause region of the earth's magnetosphere.

The micropulsation data obtained with the magnetometers at Siple and Roberval along with data obtained by other ground-based passive and active techniques and by satellites will be used to study (1) the generation and propagation of micropulsations, (2) the propagation of micropulsation through the ionosphere under varying seasonal solar and local time conditions, and (3) the dispersive properties of the magnetospheric medium, and (4) the stimulation of micropulsations by the VLF transmitter at Siple. Field support at Siple Station is required for one person during the austral summer of 1979-80.

SUPPORTED BY U.S. National Science Foundation, Div. of Polar Programs

5.0032, DESIGN MODIFY MOBILE TM STA/SUPPORT

C. Erickson, New Mexico State University, Las Cruces Campus, Graduate School, *University Park, Las Cruces, New Mexico* 88003 (DF580140; F19628-78-C-0070)

AF function - remote balloon flight support capability. Deficiency - lack of Air Force mobile computer-interfaced PCM telemetry and command control facilities applicable to balloon control from remote locations. Objective - provide state-of-the-art telemetry and balloon control facilities at AFGL mobile ground station. How research contributes -increases the versatility and cost effectiveness of scientific balloon platforms by providing experimenters the capability for high data rate PCM telemetry reception and balloon control functions from a mobile ground station at remote sites.

Design and fabricate special computer interface and display equipment for a PCM ground station. Provide hardware and software interface for the mobile station-installed equipments.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0033, ION MEASUREMENTS IN THE LOWER D-REGION

R.O. Olsen, U.S. Dept. of Defense, Army, Electronics Research & Development Command, Atmospheric Sciences Lab., *White Sands M.R., Las Cruces, New Mexico* 88002 (DA0F1790)

The technical objective is to accomplish the following tasks: (a) flight of appropriate rocket-borne and balloon-borne instruments into the very low d-region (40-50 km) in order to acquire in situ data concerning ion masses (including cluster ions), ion mobilities, and related upper atmospheric data of importance to ELF/VLF propagation and (b) evaluation of data obtained on these flights against theoretical and laboratory measurements so that the data can subsequently be employed to evaluate and improve existing ELF/VLF models employed in applicable predictive computer codes.

A balloon-borne positive ion/negative ion mass spectrometer payload will be flown to obtain mass-identified ion measurements. The rocket-borne probes will consist of Gerdien condensors to measure ion mobility and blunt probes to measure ion conductivity.

SUPPORTED BY U.S. Dept. of Defense, Electronics Research & Development Command, Atmospheric Sciences Lab.

5.0034, CHEMICAL WEATHERING ON MARS

Unknown, University of New Mexico, Graduate School, *University Hill N.E., Albuquerque, New Mexico* 87106 (NSG 7579)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Headquarters, NASA

5.0035, ELECTRIC FIELD AT SEA

B. Vonnegut, State University of New York, Albany Campus, School of Arts & Sciences, Dept. of Atmospheric Science, *1400 Washington Ave., Albany, New York* 12222 (DN123236; N00014-75-C-0221)

The objective of this research is to examine and measure the variables of the atmospheric regime at sea to which naval equipment and systems are exposed, and to establish the preliminary climatology of that regime to provide the necessary handbook data for purposes of improved design and operation of communications, detection and other naval equipment.

For measurement of electric fields at sea during disturbed weather, a retractable corona point mounted on a float is used. A threshold value of the electric field will put the point into corona. The corona current in turn actuates a motor which lowers the corona point. The height of the point gives the value of the field. Additionally, equipment has been developed for the space shuttle flight of 2 July 1979 to detect and record lightning strokes occurring both over land and sea.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

5.0036, ATMOSPHERIC POLLUTION - DEVELOPMENT AND APPLICATION

J.S. Hogan, State University of New York, Stony Brook Campus, School of Engineering & Applied Science, Dept. of Mechanics, *Stony Brook, New York* 11794 (NCC 5-7)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0037, A SYNERGISTIC INVESTIGATION OF THE INFRARED WATER VAPOR CONTINUUM 14702-GS

R.K. Long, Ohio State University, Columbus Campus, School of Engineering, Dept. of Electrical Engin, *190 N. Oval Dr., Columbus, Ohio* 43210 (DA0F8989; DAAG29 77 C 0010)

To investigate water vapor continuum absorption in the 8 micrometer to 12 micrometer and in the 3.5 micrometer to 4 micrometer atmospheric transmission windows. Relevance - the absorption of infrared radiation in the atmosphere has application to weapons guidance systems, infrared imaging, remote sensing of atmospheric pollutants and more. Of particular relevance is increased knowledge of atmospheric attenuation effects on infrared laser transmission.

The research will combine Fourier transform spectroscopy and laser transmittance measurements in a single experimental procedure utilizing a stainless steel multiple traversal absorption cell with optical and mechanical systems to allow maximum path lengths up to 2 kilometers.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

5.0038, SPACE AND TIME VARIABILITY IN THE UPPER ATMOSPHERE

N. Engler, University of Dayton, Research Inst., *300 College Park Ave., Dayton, Ohio* 45469 (DA0F1767; DAAD07-78-C-0020)

Analyze rocketsonde data to determine and space variability of upper atmospheric density, temperature, pressure and winds, and remove observed biases from ballistic sphere program; study gravity waves in robin sphere data; design field experiments for improving analysis capability. (External effort supporting DA 0F 1768).

Contractor will conduct a literature search concerning variability of the upper atmosphere in the tropics. A data base will be assembled consisting of all datasonde, spheres, and other soundings that lend themselves to temporal and spatial analysis. Emphasis will be placed on variations that are larger than the particular sensor used in collecting the data. In addition, the Robin 77 computer program will be tested for accuracy. This program will be used to study possible vertical motions in past data sets already available at UDRI. Under a previous contract a ballistic sphere program was developed and tested. Biases were detected--the source will be investigated and removed. A diurnal launch series of sphere firings will be analyzed for the presence of gravity waves.

SUPPORTED BY U.S. Dept. of Defense, Electronics Research & Development Command, Atmospheric Sciences Lab.

5.0039, CONDUCT SHORT COURSES IN REMOTE SENSING

Unknown, Murray State College, Undergraduate School, *Tishomingo, Oklahoma* 73460 (NAS13-111)

SUPPORTED BY U.S. National Aeronautics & Space Admin., National Space Technology Lab.

5.0040, ALTIMETER DATA OVER TRENCHES AND ISLAND ARCS AND CONVECTION IN THE MANTLE

G.M. Jones, Texas A & M University, College Station Campus, School of Geosciences, Dept. of Geophysics, *College Station, Texas* 77843 (NCC 5-11)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0041, NAVY ENVIRONMENT; GULF STREAM STUDY

A.D. Kirwan, Texas A & M University, College Station Campus, School of Geosciences, Dept. of Oceanography, *College Station, Texas* 77843 (DN675367; N00014-75-C-0537)

Gulf stream rings cause anomalies in the depth of the Sofar channel which in turn affect range and bearing in ASW operations. The purpose of this project is to determine the variations of the dynamics of the Gulf Stream by theoretical and observational means. Lagrangian measurements of the stream path, vorticity, horizontal divergence and Reynolds stresses will help explain the formation and break-off of Gulf Stream rings. Stream paths will also be measured in the vicinity of Pacific mesoscale eddies.

The research consits of a theoretical testing of theories of the dynamical balances that exist in the Gulf Stream and an applied drifter program. Clusters of drifters will be released in the North Pacific near ship station Papa as part of the NORPAX ADS program. The drifters will be tracked remotely by highly accurate position fixing systems associated with the Nimbus-6 satellite. The trajectories and differential motions of individual drifters in the clusters will yield data on the stream axis, the velocities, and the horizontal velocity gradients in the stream. This data will be used

to test the vorticity balance and seasonal variability of the stream. The satellite drifters and tracking system has been successfully deployed in the Gulf Stream and in the NORPAX Anomaly Dynamics Study (ADS) cruises I, II, and III. The drifters were non-dispersive in the stream; some remained in a ring while others followed the main flow. Vastano, A.C., and A.D. Kirwan, Jr., 1977: Tracking the Kuroshio by Nimbus-6. Naval Research Reviews. Vol. XXX No. 6.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

5.0042, COOPERATIVE PROJECT SUPPORT OF THE LUNAR SAMPLE PROGRAM

E.K. Gibson, U.S. National Aeronautics & Space Admin., Office of Manned Space Flight, Lyndon B. Johnson Space Center, *Houston, Texas* 77058 (EAR7910470)

This will support the travel and living expenses for Dr. Everett Gibson from the National Aeronautics and Space Administration while on temporary assignment to the National Science Foundation. Dr. Gibson will provide technical assistance in the Geochemistry Program, which is now considering proposals involving lunar sample analysis as mandated by Congress. Dr. Gibson has been involved in NASA's Lunar Sample Analysis Program, so can provide valuable assistance in this area. He also has expertise in igneous petrology and will assist the Geochemistry Program in areas other than lunar sample analysis.

SUPPORTED BY U.S. National Science Foundation, Div. of Earth Sciences

5.0043, MORPHOGENETICS STUDIES ON MARTIAN CHANNELS

V.R. Baker, University of Texas, Austin Campus, School of Natural Sciences, Dept. of Geological Sciences, *200 W. 21st St., Austin, Texas* 78712 (NSG 7557)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

5.0044, ISIS II DATA ANALYSIS

D.J. Winningham, University of Texas, Health Science Center at Dallas, Graduate School, *Dallas, Texas* 75230 (DF582400; F19628-76-C-0005)

AF function - communications and detection. Deficiency - understanding ionospheric effects of particle precipitation in the arctic which degrade communications in that region. Objective - investigate the effects of auroral particle precipitation, measured by the ISIS-II satellite, on the ionization balance of the high-latitude ionosphere. How research contributes - this research effort is conducted to establish direct relationships between incident particle fluxes and specific features of the high-latitude ionosphere which result from these particles. A description of optical and plasma properties of the ionosphere from the measurement of particle fluxes, and the behavior of these properties during substorms, will lead to more effective and adequate interpretation of the satellite measurements and enhance remote sensing capabilities. Analysis of soft particle spectrometers data from the ISIS 2 satellite also provides a framework for data collected by the AFGL Airborne Ionospheric Observatory.

Assemble and interpret ISIS-2 soft particle spectrometer data to specify the structure of the ionosphere in the region of the auroral oval and F layer trough. Reduce particle data taken during selected aircraft periods for correlation with DMSP auroral photos and aircraft data. Investigate ability to use 6300A degrees photometer data as an indicator of FOF2 in the polar trough region.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0045, ESTABLISH A TETHERED SUBSATELLITE FACILITY DEFINITION TEAM

P.M. Banks, Utah Higher Education System, Utah State University, School of Science, Dept. of Physics, *Main Bldg., Office 104, Logan, Utah* 84321 (NAS 8-33383)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Marshall Space Flight Center

5.0046, RADIATIVE TRANSFER MODEL FOR REMOTE SENSING OF LASER-INDUCED FLUORESCENCE OF PHYTOPLANKTON IN NON-HOMOGENEOUS TURBID WATERS

D.D. Venable, Hampton Inst., Graduate School, *Hampton, Virginia* 23368 (NCC 1-11)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

5.0047, AIR-SEA INTERACTION STUDIES FOR SATELLITE MEASUREMENTS

K.B. Katsaros, University of Washington, School of Arts & Sciences, Dept. of Oceanography, *Seattle, Washington* 98105 (NAS 6-2996)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Wallops Flight Center

5.0048, AN INTERDISCIPLINARY RESEARCH PROGRAM IN CLIMATOLOGY

J.E. Kutzbach, University of Wisconsin, Madison Campus, School of Letters & Science, Dept. of Meteorology, *500 Lincoln Dr., Madison, Wisconsin* 53706 (ATM7423041A04)

The project on an interdisciplinary research program in climatology at the University of Wisconsin addresses the objectives of the understanding of the world's climate, its causes and evolution in time and its impact on the patterns and changes of ecological systems. A group representing a variety of pertinent disciplines, (meteorology, climatology, geology, paleoclimatology, palynology, hydrology, numerical modelling, ecology) will continue the cooperative work with special emphasis on: (1) diagnostic studies of climate variability from instrumental records; (2) diagnostic studies of past climates as inferred from paleoclimate records; (3) modelling of climate and climate variability and (4) studies of the ecological effects of climatic variability and of quantitative relationships of macroclimate, microclimate, and biota, including man. This fourth aspect of the program will be supportive of an applied program within the Center for Climate Research: the World Climate/Food Systems Study.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

5.0049, TRANSFER OF INFRARED AND VISIBLE RADIATION THROUGH CLOUDS OF FINITE HORIZONTAL AND VERTICAL EXTENT 15227-GS

J.A. Weinman, University of Wisconsin, Madison Campus, School of Letters & Science, Dept. of Meteorology, *500 Lincoln Dr., Madison, Wisconsin* 53706 (DA0F9223; DAAG29-78-G-0109)

To investigate the transfer of visible and infrared radiation through clouds of finite horizontal and vertical extent. Relevance. applicable to current research on obscuration by military smokes and natural clouds, and the interpretation of visible and infrared imagery from meteorological satellites. The research will provide a means to incorporate multiple scattering into the jtcg-messep obscuration model, the lack of which is the most serious shortcoming of the model.

Extend both a monte carlo and a fast analytical model partly developed to provide radiances in the visible region from isolated clouds, into the infrared region. Consideration also will be given to the intrinsic cloud properties such as extinction coefficient, single scatter albedo, and scattering phase function; and the effects of the underlying surface and the atmosphere in which the cloud is imbedded.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

5.0050, IONOSPHERIC AND PLASMASPHERIC TOTAL ELECTRON CONTENT STUDIES IN THE SOUTHERN HEMISPHERE

Unknown, Universidade MacKenzie, *149 Rua Itambe, C.P. 8792, Sao Paulo, Brazil* (DA0D9315; DAERO 77 G0029)

To undertake studies of the ionosphere so as to be able to predict its temporal and spatial properties so as to allow a single channel radio satellite navigation system to be developed.

Development of total electron content of the ionosphere and plasmasphere measurements using faraday rotation and group delay techniques. These measurements are based on ats-6 transmissions, and are performed at different locations in brazil, depending on satellite's 'visibility', and interests on specific geographic locations (for example, the geomagnetic anomaly, the geomagnetic equator).

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Research & Standardization Group

LIFE SCIENCES

Includes Life Sciences (general); Aerospace Medicine; Behavioral Sciences; Man/system Technology and Life Support; and Planetary Biology.

6.0001, RULE LEARNING AND SYSTEMATIC INSTRUCTION IN PILOT TRAINING

V.S. Gerlach, Arizona State University, School of Education, Dept. of Educational Technology & Library Science, *Tempe, Arizona* 85281 (DF041950; AFOSR-76-2900)

AF function - the Air Force conducts an extensive and costly undergraduate flying training program. Deficiency - the Air Force is restructuring its flying training programs to accommodate the substitution of simulator time for blocks of instruction previously carried out in airborne flight training vehicles. There is no available instructional technology to guide this transition. Objective - the goal of this research is improved strategies and instructional methods for undergraduate pilot training. How research contributes - this research will provide improved instructional methods for use by instructor pilots involved in the use of simulation, ground instruction, and instructions using the T-37 aircraft.

The following will be studied: rule learning as a prelude to the acquisition of complex psychomotor skills, internalization of a response repertoire, and the acquisition of chained sequences of behavior that characterize the proficient aircraft operator.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

6.0002, DEVELOPMENT OF A LOW BREATHING RESISTANT 60,000 FOOT ALTITUDE AIRCREW OXYGEN MASK

R.C. Pestridge, Garrett Corp., *402 S. 36th St., Phoenix, Arizona* 85034 (DF323410; F33615-78-C-0604)

A newly designed prototype oxygen breathing crewman's mask that is capable of providing emergency protection to an altitude of 60,000 feet is required. It must also provide maximum comfort at lower altitudes, and offer a minimum of breathing resistance. It must hold to the face without slippage in high gravity fields up to 8 plus Gz. A design is desired that utilizes a minimum number of different sizes to fit the 5th through the 95th percentile anthropometric sizes.

The desired approach is a current state-of-the-art examination, with modifications and innovations made that are necessary to design and produce an oxygen breathing mask that will meet the desired objectives. Mask design, fabrication, testing, and delivery of prototype model are the responsibility of the contractor. Testing will be accomplished at contractor's installation by his personnel. Environmental assessment will be updated to include contractor when the selection is made.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0003, E-3A MISSION SIMULATOR (MS) FOT&E PHASE II

N.C. Varney, U.S. Dept. of Defense, Air Force, Human Resources Lab., *Williams Air Force Base, Chandler, Arizona* 85224 (DF224260)

Specific objective requiring AFHRL support described above includes: assess the psychological fidelity and the ECM simulation fidelity of the MS, assess the instructional features of the MS, assess the capability of the simulation support function, assess the human factors engineering of the simulation support capsule, assess the training capability of the MS.

AFHRL/FTR will provide on-site evaluation of the capability of the instructional and simulation support features in the capsule to provide a functional environment for training mission crew tasks. This includes data collection, processing, and analysis. AFHRL/SM will process computer cards which will be mailed by the test team once per month and will provide quarterly and final analysis summaries to include, but not be limited to, deficiencies and conclusions/recommendations. AFHRL will also provide written summaries (interim and final) to include conclusions, recommendations, and potential deficiencies.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0004, EFFECTS OF VARYING DISPLAY PARAMETERS ON TRAINING IN THE T-4G T-37 FLIGHT SIMULATOR

R.R. Woodruff, U.S. Dept. of Defense, Air Force, Human Resources Lab., *Williams Air Force Base, Chandler, Arizona* 85224 (DF221810)

To investigate the effects of changing various engineering parameters of the T-4G (a T-37 flight simulator) on the training of Air Force undergraduate pilot trainees. Projects selected will complement future ASUPT research by investigation of variables which are fixed on ASUPT. Immediate plans are to evaluate the effect of black and white compared to color imagery and collimation compared to non-collimation of the image.

ATC instructor pilots will train groups of new student pilots to land the T-4G before they begin T-37 training. Separate, matched groups will receive equal training (i.e., number of trials) with different conditions (color, black and white, collimation, non-collimation, etc). Students' performance at the end of training will be evaluated for differences or similarities in group scores. Performance will be measured in two ways: (1) IPs will evaluate performance using a 12-point scale like that developed for use in FFT studies, and (2) ADCS (automated data acquisition and control system) will be used to record several flight parameters. ADACS measures will be correlated with IP evaluations to determine which ones are most indicative of student performance and those selected will be used in subsequent analysis.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0005, NUTRIENT RECYCLING IN A CLOSED, SYNTHETIC ECOSYSTEM - A MODEL FOR THE STUDY OF ECOSYSTEM CONTROL

L.Y. Young, Stanford University, School of Engineering, Dept. of Civil Engineering, *Stanford, California* 94305 (NCA 2-745907)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0006, DEVELOPMENT OF ULTRASONIC INDICES FOR SPACE SHUTTLE PASSENGER SELECTION

R. Popp, Stanford University, School of Medicine, Dept. of Medicine, *Stanford, California* 94305 (NCC 2-1)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0007, BONE TURNOVER AND ENDOCRINE STATUS IN RATS ON A MO MODEL SYSTEM THAT SIMULATES WEIGHTLESSNESS

C.D. Arnaud, University of California, San Francisco Campus, School of Medicine, Dept. of Medicine, *551 Parnassus Ave., San Francisco, California* 94122 (NCA 2-665902)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0008, GZ EFFECTS ON HUMAN OPERATOR PERFORMANCE

D.L. Klienman, University of Connecticut, Storrs Campus, School of Engineering, Dept. of Electrical Engineering, *Box U-37, Storrs, Connecticut* 06268 (DF324400; F33615-78-C-0517)

The intent of this work unit is to upgrade the tactical Avenger air-to-air engagement model with an improved human tracking model subroutine which includes the effects of high-g forces on pilot performance.

The University of Connecticut will extend the optimal control model to include the effects of high-g forces on pilot performance in an aerial tracking task. Static tracking experiments will be conducted by the University of Connecticut including a study of the effects of gun sight lead computing dynamics. Motion based g-stress experiments will be performed at AMRL using the dynamic environment simulator (DES). The experimental program conducted at the University of Connecticut will concentrate on determining the effects of target motion and visual cues on tracking performance. Air-to-air tracking on the DES will be studied to analyze the interplay between attacker aircraft dynamics and target movement, and to refine the static model.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

6.0009, MODELLING TRANSIENT MOTION CUE EFFECTS

A.M. Junker, Bolt Beranek & Newman Inc., *50 Moulton St., Cambridge, Massachusetts* 02138 (DF320790; F33615-77-C-0506)

At AMRL-EM, an extensive research program is being pursued to investigate motion-related performance of the pilot (human operator). This effort includes basic studies to determine (a) how pilots utilize motion-related sensory cues in real or simulated flight and (b) how this aspect of pilot response behavior can be included in models for pilot/vehicle systems. Bacause many tracking tasks of interest to the military (e.g., air-to-air combat) are nonsteady state, the pilot model must be applicable for transient, as well as steady-state, maneuvers. Therefore, the objective of this work unit is to investigate the effects of motion in nonsteady-state tracking situations. The present Bolt Beranek and Newman, Inc., (BBN) pilot model contains features needed to explore the various aspects of motion cues in transient tasks. Therefore, BBN's assistance will be utilized through this work unit.

A program to explore the pilot's use of motion cues in transient aircraft maneuvers will be performed. BBN will assist in the validation of a model concerned with the pilot's use of motion dues during transient aircraft maneuvers. This analytic study will be correlated with an ongoing experimental study at AMRL/EM.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

6.0010, DYNAMIC CHARACTERISTICS OF HUMAN MOTOR PERFORMANCE IN CONTROL SYSTEMS

C. Terzuolo, University of Minnesota, Minneapolis Campus, School of Medicine, Dept. of Physiology, *1305 Mayo, Minneapolis, Minnesota* 55455 (DF040490; AFOSR-75-2804)

AF function - in the design of control systems for aircraft and in other situations where a human operator is involved, it is necessary to know in precise terms the motor characteristics of man's muscular capabilities expressed in the mathematical language of the control system engineer. Deficiency - such data for man are incomplete. No fully adequate predictive model of man's movements is available. Research -this group is developing a model of human motor control with the aid of computers based on neurophysiological experiments. The model will incorporate nonlinearities known to exist in the human central nervous system. How contributes - the results will be in terms directly useful to engineers designing aircraft controls or other humanly activated controls in Air Force equipment and is applicable to AFSC RO 1.8.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

6.0011, DEVELOPMENT AND APPLICATION OF A TASK TAXONOMY FOR TACTICAL FLYING

R.P. Meyer, Design Plus, *St. Louis, Missouri* (DF223300; F33615-77-C-0020)

To develop a procedural methodology which tactical operational training personnel can use in the construction of continuation training programs for aircrews and to investigae the relationship of specific behaviors to the proficiency of aircrew skills. The product of this effort should provide reliable procedures for determining and structuring the content of aircrew continuation programs.

Application of a flying task taxonomy developed for tactical aircrew skills will be used. Taxonomic methodology will provide a conceptual structure for classifying flying training tasks into skill groups for comparison of inter-task relationships.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0012, PROPOSAL TO PARTICIPATE IN THE TESTING AND EVALUATION OF A TOTAL VIRAL MONITORING INSTRUMENT

M.R. Hall, University of Nevada, System Office, Desert Research Inst., *Reno, Nevada* 89507 (NCC 2-6)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0013, VESTIBULAR SYSTEM RESPONSE TO ACOUSTIC ENERGY

D.E. Parker, Miami University, Graduate School, Dept. of Psychology, *Oxford, Ohio* 45056 (DF313120; F33615-76-C-5029)

Air Force function - operational stress, environmental acoustic hazard to aircrew personnel. Deficiency - the manner in which high-intensity acoustic energy contributes to dis-orientation in Air Force crewmembers is very poorly understood. Research - investigate the manner in which acoustic energy stimulates the vestibular system. How research contributes - research will indicate how high-intensity noise affects equilibrium and produces disorientation. Results will contribute toward the development of threshold criteria for hazardous exposure to high-intensity sounds.

This research will better define the dynamic response of the vestibular system to acoustic stimulation, in terms of intensity level, acoustic frequency (Hz), and intermittency rate of the stimulus. Thresholds will be determined for nystagmic and counterrolling eye movements, and postural adjustments. A study of the nature and mechanisms of the transfer of acoustic energy to the vestibular system will be made by studying stapes displacement and perilymph and endolymph pressure changes.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

6.0014, CREW SAFETY REQUIREMENTS AND EVALUATION CRITERIA FOR B-1 ESCAPE SYSTEMS

J.W. Brinkley, U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF322770)

The first three B-1 prototypes incorporate a crew module escape system; however, due to high life cycle costs and technical problems the crew module escape system was abandoned for future production aircraft. Emergency escape will be provided by four ejection seats for primary crewmembers and an escape hatch for instructor aircrew. The objective of this effort is to provide aeromedical consultation on the degree of crew protection provided by the ejection seats.

Technical support will be provided during the preparation of computer programs required to process acceleration data recorded during the ejection seat qualification program. The processed data from these tests will be analyzed by this office as required by the B-1 System Program Office. Biomechanical criteria for an analysis of the effectiveness of the ejection seat trajectory divergence system will be provided within the limits of the existing biotechnology. Aerodynamic data obtained from the

contract effort documented under work unit 72310648 will be provided to the B-1 SPO as it becomes available. These data will quantify the parameters necessary to determine influence of the aerodynamic properties of the human body and the influence of the body position on trajectory divergence and escape system stability.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

6.0015, COMPASS EARS

L.L. Griffin, U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF321000)

To provide human engineering criteria and design consultation in the design, development, test and evaluation of the Compass EARS project. The emphasis of this support is upon the specification and selection of information display and communications equipments. The design and evaluation of workspace arrangement and environment, operator safety and design for maintenance also receive significant attention. It is anticipated that experimental research will be required to provide viable solutions for the system information handling, processing and transfer within the system.

Application of human engineering design criteria, within the framework of MIL-STD-1472B, to the interfaces, processes and performance of the system and technical evaluation of research proposals to the program manager for solutions of the longer range information processing problems which require system specific research.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

6.0016, MECHANISMS OF NONDESTRUCTIVE COUNTERMEASURES AGAINST THE HUMAN VISION SYSTEM

E.J. Hartzell, U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF318860)

At some point in effective threat systems, there is at least one human operator serving in a primary or backup role as a system controller. The human operator controls his system on the basis of visual information about the position and relative motion of the target. The objective of this effort is to investigate psychophysical mechanisms which may be effective countermeasures against the human vision system. The work will be coordinated with the AF Avionics Laboratory and the U. S. Navy Missile Test Center, Point Mugu, CA. The results of this effort will relate the mechanisms underlying successful empirical experiments conducted in the past and in progress jointly sponsored by these organizations as well as the U. S. Army.

The approach involves a series of human experiments utilizing the computational and simulation facilities at the AMRL. Human performance will be evaluated, presence of potential countermeasures including: frequency of flashing lights, signals having patterns or cognitive value, varied signal intensity and varied wavelength. Of particular concern are the display media and task viewing mechanisms.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

6.0017, APPLICATION OF HUMAN BODY MODELS

I. Kaleps, U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF323100)

Sophisticated computer-based biodynamic models having a capability to predict in great detail both internal and external response of the human body resulting from high-level mechanical stress exposures have been developed. The present effort seeks to modify and refine these model formulations to optimize applicability to Air Force and flight operations oriented problems, to develop comprehensive graphic display capability to facilitate interpretation of analytically predicted results and to carry out model validations using experimental data obtained from separately conducted experimental programs at the Biodynamics and Bionics Division of the Aerospace Medical Research Laboratory and at other institutions.

This effort will emphasize the application of the head-spine model and the articulated total body (ATB) model to problems related to exposures of the head-spine system to high stresses and human extremity excursions during whole-body accelerations, respectively. These models will be refined to accommodate complex restraint system properties, include rate-dependent force effects, define appropriate interactions with the environment corresponding to high mechanical stress flight operation conditions and allow use of broad anthropometric data bases for study of responses of various percentile subjects. Graphic displays of various degrees of sophistication will be developed and generated in hard-copy form, CRT display or directly on film for time-sequenced examination. Parameter sets corresponding to selected experiments will be compiled and used for computer input for simulation of the particular experiments. Comparison of actual experimental results with predicted model output will be used as a basis of model validation and/or modification.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

6.0018, COMPARATIVE RESPONSE OF MAN AND ANIMALS EXPOSED TO IMPACT

L.E. Kazarian, U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF322420)

Spinal injuries due to abrupt gz impact forces occur frequently in the operational Air Force environment. Injury patterns experienced are diversified, and range from simple vertebral body fracture to vertebral subluxation with spinal cord and nerve root involvement. The objective of this investigation is to provide an in-depth biomechanical and clinical analysis of operational spinal injury patterns for purposes of supporting injury prediction model development, which will in turn be used as system design aids, and further to understand the microscopic and macroscopic failure mechanisms which are involved in the kinetic and kinematic events resulting in injury.

Interspecies scaling relationships will be formulated between the squirrel monkey, rhesus monkey, baboon, chimpanzee and man. The musculoskeletal system will be modeled based upon geometry and material property data. Experimental data will be collected on isolated verbetral bodies, vertebral units and the points of rib articulation. Data will be collected on the ranges of torso motion. These data will be integrated into a generalized mathematical model of the torso. Experimental data will be collected on injury modes and correlated to specific support and restraint geometries for model injury prediction validation. Subsequent studies will be made applying the model to the predictive analysis of injury for various restraint configurations and modes of human exposure in potential and existent Air Force systems.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

6.0019, PROJECT 5973 SUPPORT

D.F. Kocian, U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF321190)

This work unit will continue to support project 5973, Development of Visually Coupled Aids, with technical support following transition of the engineering development program to ASD/AE. This support, in accordance with transition guidelines, will include both technical and human factors inputs to the hardware development as well as the test and evaluation phases of the program. Through such inputs the program will be provided with necessary technological advances, performance measures on candidate VCS subsystems, and interface criteria for VCS components in various applications testing. This effort supports AFSC development goals TC-2, TC-4, TC-5, TC-7, and MS-4, and PMDR-P2033(5)/64708F/5973, Visual Coupling Aids.

Promising VCS component technology will be developed to the point where it can be incorporated into the 6.4 program in ASD/AE. Technical and human factors inputs will be provided to test efforts such as single seat attack (SSA), visual aided tracking system (VATS) and project Quick Strike. This includes support

for both ground-based simulation as well as flight testing. Measurement data on various VCS component capabilities will be provided using the image metric laboratory and, in some cases, final acceptance testing of deliverable systems will be performed. Helmet integration of VCS components will be pursued and basic helmet development and interface work will be applied where appropriate. Methodology for providing an efficient, timely flight test support capability will be evolved and coordinated with ASD/AE on a regular basis.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

6.0020, BIOASSAY IN SOIL MICROORGANISMS
S.A. London, U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF320500)

To utilize microbial systems for evaluating the potential environmental impact of various materials used in air force operations, such as missile propellants, aircraft fuels and lubricants and other substances used in consequential amounts that could have acute and/or chronic environmental effects. The data derived from this effort are considered in conjunction with similar results obtained with other biological indicator and test systems to form a data base upon which scientifically valid environmental impact assessments and statements can be prepared. The microbial bioassay portion of work unit 6302-04-11 was transferred to this work unit.

Microbial cultures isolated from soil samples will be investigated concerning their responses to both acute and chronic exposure to potential environmental pollutants. Selection of species will be based upon: (1) applicability of physiological requirements to experimental procedures, (2) relationship of responses to pollutant exposure with ecosystem impact. Microbes will be studied under both closed (batch) system and open (steady-state growth) system conditions to ascertain acute and chronic effects. Responses to be evaluated will include growth kinetics, bacteriocidal/bacteriostatic effect, physiological changes, genetic (mutation) effects, pollutant degradation or accumulation. This effort will establish no-effect levels for single and multiple cultures and will serve as both a laboratory test system and a means of predicting potential environmental consequences of inadvertent intrusion in soil and water of Air Force materials.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

6.0021, STUDY EXCESS SOUND ATTENUATION (ESA) AND DEVELOP ESA MODEL WITH RESPECT TO AIRBASE/COMMUNITY NOISE
R.G. Powell, U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF321410)

The noise produced on-base and in communities by Air Force airbase operations is a major environmental concern. The airstaff, majcoms, and airbases assess the impact of such noise by applying community noise predictive models (i.e., Noisemap) and noise data (i.e., USAF Bioenvironmental Noise Data Handbook, Noisefile) developed by AMD/AMRL under work units 72310418, 24, 25, 28, 31, and 33. The accuracy of these predictive models and data depend in large part on the accuracy of the algorithms used to account for excess sound attenuation (ESA) caused by reflection/absorption of sound by the earth's surface/ground cover (e.g., sand, grass, crops), scattering caused by wind turbulence, obstacles (e.g., buildings, trees), and other factors. Although the ESA model presently used is the best available, it has significant uncertainties which cause corresponding uncertainties in the environmental noise assessments. The objective of this work unit is to develop better models for more accuractely predicting ESA in forms suitable for practical implementation in Noisemap, the handbook, and Noisefile.

AMRL will conduct airbase noise measurements over a 1-2 year period using 6-10 all-weather acoustic measuring stations. Data taken will define ESA over a range of 75 m to several kilometers from the source for all times of day/night, all seasons, various weather conditions, and for flat farm land and urban/suburban areas. Statistical analyses will provide the basis for new empirical ESA models which better define such attenuation for specific classes of conditions (e.g., day/night, ruarl/suburban, summer/winter).

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

6.0022, EVALUATION OF BIODYNAMIC RESPONSE TO ESCAPE SYSTEM AND AIRCRAFT CRASH ENVIRONMENT
P.A. Graf, University of Dayton, Research Inst., *300 College Park Ave., Dayton, Ohio* 45469 (DF320280; F33615-76-C-0525)

The objectives are (1) to provide an efficient means for processing impact data collected on the various AMRL impact facilities as well as data collected by other governmental agencies for analysis by the AMRL, (2) to provide statistical analysis capability to support the design of impact experiments, (3) to provide a continuous error analysis program with respect to data collection and processing methods and (4) to provide data in finished form to ultimately be used by AMRL investigators to establish system design criteria or to evaluate the effectiveness of existing systems.

Data handled under this program will be processed and analyzed using conventional techniques. New methods or modifications of existing techniques may be developed and recommended by the contractor to meet specific program requirements.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

6.0023, A CAPACITY-THEORETIC APPROACH TO WORKLOAD ASSESSMENT
H.A. Colle, Wright State University, Graduate School, *Dayton, Ohio* 45431 (DF052210; AFOSR-78-3595)

AF function - this research examines a capacity-theoretic metric which can be used for assessing workload requirements, especially within the context of aircrew operations. Deficiency - workload assessment is very difficult in cockpit activities since attentional demands made on different crew members are hard to observe and quantify. Yet good workload measures are needed to satisfy aircraft design questions and provide aircrew performance measurement for training. Objective - this research will attempt to validate a capacity-theoretic approach to measuring workload. How work contributes - the current technology for assessing workload will be advanced as a result of this effort. Better performance measures should improve R and D for aircrew training.

The principal investigator has developed quantitative approach to workload assessment which employs a fixed capacity theory of attentional demand where each person has a maximal amount of processing resources which can be distributed among the tasks to be performed. Some work completed by the investigator during an AFOSR summer faculty program using performance operator curves suggests that the assumption of fixed capacity is a valid one. This research will test that assumption further in its general form using visual memory classification, paced auditory digit-shadowing, and digit-adding tasks in a dual-task paradigm.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

6.0024, AEROMEDICAL DESIGN AND ENGINEERING ANALYSIS
C.S. Acosta, U.S. Dept. of Defense, Air Force, School of Aerospace Medicine, *Brooks Air Force Base, San Antonio, Texas* 78235 (DF322120)

To provide aeromedical design and engineering support to major commands for biomedical systems developed by USAFSAM and accepted for operational use. Prepare instructions and maintenance information for equipment users, and prepare technical reports to document completed R&D efforts.

Prepare required acquisition documentation, monitor systems acquisition, provide operation and maintenance instructions to system users, assist in identifying and eliminating operational deficiencies, and prepare required USAFSAM technical reports upon completion of development efforts. This work was previously documented under work units 7755-15-01 and 7996-02-AA.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0025, REITAN VALIDATION
J.L. Green, U.S. Dept. of Defense, Air Force, School of Aerospace Medicine, *Brooks Air Force Base, San Antonio, Texas* 78235 (DF321710)

The Halstead-Reitan neuropsychological test battery is a standardized set of subtests administered and scored by a technician. The psychology function, neuropsychiatry branch, has undertaken the design and fabrication of subtest equipment which will permit automated administration and scoring via computer. The objective of this effort is to establish normative data using the automated subtests that can then be used in diagnostic evaluation of aircrew by the Aeromedical Consultation Service. Preliminary work with this test confirmed that published standards or 'norms' for the general population were not completely valid in the highly select (aircrew) population. New standards will refine the definition of normal/abnormal performance in aircrew.

Subjects undergoing evaluation by the Aeromedical Consultation Service who are free of suspected/diagnosed neuropsychiatric disorders will routinely receive the Halstead-Reitan neuropsychological test battery to establish standards for 'normal' subjects. First, this will require validation of the new automated subtests, and second, determination of normal ranges and statistical averages for USAF normal fliers, normal nonfliers, head injured fliers and head injured nonfliers. The results obtained via the new automated reitan will be compared with the standard manual Reitan.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0026, REHABILITATION OF AIRSICK AIRCREWMEN
H.H. Hanna, U.S. Dept. of Defense, Air Force, School of Aerospace Medicine, *Brooks Air Force Base, San Antonio, Texas* 78235 (DF321950)

To determine the value of a specific rehabilitative effort in aircrewmen with chronic airsickness of such severity as to warrant suspension.

Each aircrewman referred to USAFSAM for airsickness will receive the standard aeromedical evaluation. If no organic basis for the airsickness can be found and the patient has no significant psychiatric condition, he will be considered suitable for rehabilitation. With the subject's concurrence, he will then receive self-paced incremental coriolis stimulation (usually twice a day) and psychotherapy (reciprocal inhibition), usually for ten working days. Upon completion of rehabilitation, the subject will return to his duty station with the recommendation that he be returned to flying duties on a trial basis to see if he has benefitted sufficiently to perform adequately in his assigned aircraft. This work was formerly documented under 7755-08-04.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0027, ANALYSIS OF GROUND CREW PROTECTIVE EQUIPMENT
L.G. Myhre, U.S. Dept. of Defense, Air Force, School of Aerospace Medicine, *Brooks Air Force Base, San Antonio, Texas* 78235 (DF324060)

This effort is to identify and prioritize ground crew life support and protective equipment problem areas which warrant investigative attention. When the acquisition of high-quality/high-reliability protective equipment is required for ground crew problem areas, USAFSAM will support ASD/AEL in the test/evaluation of available equipment to assure that they are acceptable to specific USAF requirements.

The initial phase of this effort will be devoted to documentary research, seeking out and identifying problem areas. Once identified and prioritized, appropriate protective equipment will be procured and tested for adequacy. When more than one commercially available item exists, all will be tested and rated as to performance characteristics under the specific conditions imposed on the ground crew member.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0028, THE IMPORTANCE OF PROVIDING STEREOSCOPIC VISION IN TRAINING FOR NAP-OF-THE-EARTH FLIGHT
D.E. Erwin, U.S. Dept. of Defense, Army, Research Inst. for the Behavioral & Social Sciences, Unit Train & Eval Sys Tech Area, *5001 Eisenhower Ave., Alexandria, Virginia* 22333 (DA644182)

The Army has begun to design, develop, and procure flight simulators for the Cobra attack helicopter. The rationale for this rather significant investment is that flight simulators are both cost-and training-effective. The cost-effectiveness of flight simulation is unquestionable. Training effectiveness is not, unfortunately, as clear-cut a matter. The visual display in simulators currently being procured is bioptic--essentially that seen if the air space was monitored with one eye. This means that the pilot-trainee learns the demanding perceptual/motor coordination required for successful nap-of-the-earth (NOE) flight with only a subset of the cues for depth perception normally available in the 'two eyed' world. Considering the criticality of highly proficient obstacle avoidance ability for safe and tactically acceptable NOE flight, the Army cannot afford to train minimally proficient performance.

The research program will seek to determine the criticality of stereoscopic cues for depth perception to high-proficiency NOE flight, and will provide a recommendation regarding either design changes, or new training strategies to insure the development of maximally efficient depth perception in pilots required to fly NOE.

SUPPORTED BY U.S. Dept. of Defense, Army, Research Inst. for the Behavioral & Social Sciences

6.0029, TELEMETRY OF IN VIVO BONE STRAIN INFORMATION
D.R. Carter, University of Washington, School of Medicine, Dept. of Orthopedics, *500 17th Ave., Seattle, Washington* 98122 (NSG 2385)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

MATHEMATICAL AND COMPUTER SCIENCES

Includes Mathematical and Computer Sciences (general); Computer Operations and Hardware; Computer Programming and Software; Computer Systems; Cybernetics; Numerical Analysis; Statistics and Probability; Systems Analysis; and Theoretical Mathematics.

7.0001, MINICOMPUTER SOFTWARE DESIGN
M.J. Ackley, U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Environmental Research Lab., *Boulder, Colorado* 80302 (8AA72018)

PROJECT OBJECTIVE: To develop techniques and software for using minicomputers for on-line reduction and analysis of data from field and laboratory experiments in remote sensing.

CURRENT YEAR PLAN: To develop programming systems and data-processing routines for use by all WPL personnel involved with data logging by minicomputer. Continue to improve the present system in response to WPL requirements.

PROGRESS REPORT: Two basic minicomputer systems are installed and operating for use by all WPL projects.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Environmental Research Lab.

7.0002, PRELIMINARY ANALYSIS OF COMPUTER SYSTEM ARCHITECTURES SUITABLE FOR FUTURE ATC COMPUTERS
Unknown, H.H. Aerospace Design Co. Inc., *Cambridge, Massachusetts* 02138 (FA78WAI-99; FA161505 (TRAIS NO.))

The contractor is going to support the Federal Aviation Administration (FAA) in its planning and subsequent design of the

next generation Air Traffic Control (ATC) computer complex. To successfully perform this effort, they are expected to develop a work plan describing the step-by-step approach for each task; define all requirements of the automation program plan which will affect the ultimate computer system configuration design and life cycle cost; classify all subsystem elements and system architectures, and evaluate the various classes of system configurations.

SUPPORTED BY U.S. Dept. of Transportation, Federal Aviation Admin.

7.0003, STUDIES IN THE MATHEMATICAL THEORY OF GLOBAL CLIMATE

G.R. North, University of Missouri, St. Louis Campus, School of Arts & Sciences, Dept. of Physics, *8001 Natural Bridge Rd., St. Louis, Missouri* 63121 (ATM78-07962)

This project is a two-year continuation of the analytical study of simple climate models. Certain features of these models have been established such as multiple branch solutions, stability theory and estimates of sensitivity under specific assumptions. Further work needs to be done to provide a guide or reference line for larger model studies. Proposed work includes: the extension of a stationary perturbation theory which predicts the change in large-scale climate due to infinitesimal external changes (such as CO2 concentration); the extension of a variational principle to larger classes of models; the extension of a simple seasonal model to include climate change with ice feedback; the study of fluctuations in model solutions due to various stochastic inputs; and the extension of the simple terrestrial models to the example of the planet Mars.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

7.0004, MULTICS REMOTE DATA ENTRY

J. Cupak, Pattern Analysis Recognition Corp., *310 E. Chestnut St., Rome, New York* 13440 (DF728900; F30602-77-C-0174)

The objective of this effort is to develop the capability for remote data entry into Multics Olpars. Olpars is an interactive graphics oriented system to aid in classification logic design and is available to remote users via access over the Arpa net.

An in-house analysis will be made to determine what hardware and software is needed to allow a user to enter data into the Olpars filing system remotely. Cost factors, as well as ease of data entry, will be considered in determining what hardware will be used. The hardware and software will be implemented and then tested via the RADC Arpa net tip.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

7.0005, DATA SYSTEM OPTIMIZATION BY AUTOMATION AND RELATED IMPROVEMENTS

R.L. Denison, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF130700)

This effort specifically supports USAF in-house aerospace structural testing and gives general support to the overall technology of aerospace structural testing. Comprehensive testing is essential to demonstrate the strength and durability of military aerospace structures and for the advancement of structures technology. This testing is expensive and time consuming; these are always important factors, but in these times of austere funding and manning they are of particular significance. The objective of this effort is to optimize the AFFDL structures test facility real-time data acquisition, evaluation and presentation capability by maximizing throughput and minimizing operating costs. This will directly benefit the USAF mission by providing better, less expensive testing.

The AFFDL structures test facility includes a sophisticated network of computers, display systems and signal data converters which perform the functions of measurement data acquisition, evaluation and presentation. The resources of this network will be used in completing the work effort. The approach includes four elements and is based on previous operating experience with the network. The elements of the approach are: increased flexibility in output products, reduction of network operating manpower, optimized system availability and provision for very high speed data sampling.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

7.0006, AERODYNAMIC ANALYSIS METHODS FOR FLIGHT VEHICLES

D.E. Shereda, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF138390)

Determination of the aerodynamic characteristics of high-speed vehicles must be made early in the design development of such systems. Experimental test programs are expensive and limited in scope whereas numerical methods, while not having these problems, are accurate only within narrow limits of shape and speed. This effort seeks to expand these limits for vehicles suitable for high-speed flight, both aircraft and missiles. Numerical methods will be developed and evaluated for improving accuracy of analysis techniques.

Recently developed analysis methods will be exercised, evaluated and improved to provide increased analysis capability. New methods will be developed in areas of unsatisfactory correlations with test and flight data. An experimental program to provide data on high-performance aircraft will be conducted in-house. Comparisons of these data with latest analysis methods will provide further insight into shortcomings of updated numerical techniques.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

7.0007, REDUCING THE VOLUME OF COMPUTATION IN MONTE CARLO SIMULATION

C.G. Looney, University of Toledo, School of Arts & Sciences, Dept. of Mathematics, *2801 W. Bancroft St., Toledo, Ohio* 43606 (DF052020; AFOSR-78-3585)

AF function - aerospace vehicle design. Deficiency - present techniques for estimating missile accuracy are too expensive. Objective - to reduce computation. How work contributes - by an approximate technique for estimating missile accuracy more economical than Monte Carlo.

Missile flight simulation involves a number of random variables whose cumulative effect characterizes the distribution of hits relative to the target. An economical approximate estimate of this distribution will be sought which reduces the missile tracks followed by choosing the 'random' variables at certain percentile values and then fitting a Weibull cumulative distribution to the 'hits' obtained. A hybrid of random describing functions with the above will also be sought.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

7.0008, ALGORITHMS FOR EFFECTIVE USE OF THE CDC STAR-100 COMPUTER IN THE SOLUTION OF OVER-DETERMINED LINEAR SYSTEMS OF LINEAR EQUATIONS

S.N. Shan, Hampton Inst., Graduate School, *Hampton, Virginia* 23368 (NCC 1-7)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

7.0009, SPLINE FUNCTIONS AND APPROXIMATION THEORY

C. DeBoor, University of Wisconsin, Madison Campus, Mathematics Research Center, *610 Walnut St., Madison, Wisconsin* 53706 (DA0M9695; DAAG29 75 C 0024)

Spline functions and approximation theory are particularly appropriate for situations where conventional mathematical techniques are not applicable. These techniques have been and can be used in designing weapon systems and aircraft systems and are appropriate for analyzing test data from many military sources. The objective is to develop approximation theory including spline functions, to be applicable to the solution of differential equations, numerical integration, and interpolation problems amongst others.

Professors I.J. Schoenberg and C. De Boor, who are two very well-known researchers in spline functions, are both MRC members. The presence of these two outstanding mathematicians on the MRC staff draws many distinguished visitors to MRC, and the interaction of these people, together with personal and written communications with others in this area, has resulted in an extremely productive research group. A popular seminar on the subject has captured the interest of many MRC members as well as U.W. faculty and students. Computational experimentation has been enhanced by access to the U.W.'s Univac 1110, particulary that provided by a remote keyboard terminal.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

PHYSICS

Includes Physics (general); Acoustics; Atomic and Molecular Physics; Nuclear and High-energy Physics; Optics; Plasma Physics; Solid-state Physics; Thermodynamics and Statistical Physics. For Related Information See Also Engineering.

8.0001, EXPERIMENTAL AND THEORETICAL STUDY OF V-VI-VII COMPOUNDS

F.O. Wooten, University of California, Davis Campus, School of Letters & Science, Dept. of Physics, *Davis*, *California* 95616 (DF049470; AFOSR-77-3390)

AF function - microwave electronic devices are important elements of AF communications and countermeasures systems. Opportunity -improved performance can be expected from the use of new solid-state materials for the generation and detection of microwave signals. Present microwave solid-state device performance is limited by the properties associated with the structure of the device material. Objective - the objective of this research program is to determine if the electronic band structure of V-VI-VII compounds exhibits sufficiently interesting negative mass states to warrant further investigations of electron transport properties to ascertain their potential for utilization in solid-state microwave amplifiers and generators. How work contributes - these compounds belong to a class of group V-VI-VII compounds that have a number of interesting physical properties possibly including negative charge carriers suggesting potential technological utility, especially for microwave devices. It is anticipated that these semiconductors have negative mass charge carriers.

This research investigates experimentally and theoretically the electronic band structure of the semiconductors BiScI, BiSi, and BiSeI, as well as the Bi thiohalides BiSBr, BiSeBr, and BiSeC1.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0002, STUDIES IN CONDENSED MATTER - PARAELECTRICITY AND THE MOBILITY OF ELECTRONS ON THE SURFACE OF LIQUID HELIUM

F.G. Bridges, University of California, Santa Cruz Campus, Graduate School, Dept. of Physics, *Santa Cruz*, *California* 95060 (DMR7819761)

Experiments will be carried out in two areas of investigation, paraelectricity and the 2-dimensional electron system on a liquid helium surface. The paraelectric studies will be done with a broad band microwave spectrometer (12-210 GHz). Part of these studies will be directed at a better understanding of off-center paraelectric centers such as lithium ions in potassium bromide. Another set of experiments will couple the microwave spectrometer with hydrostatic stress techniques. This should prove a very powerful technique for the detailed studies of the off-center systems and provide a means of tuning some systems into a frequency range at which paraelectric resonance studies are more feasible.

The second major set of experiments will be directed at a better understanding of the motion of electrons on a helium surface. The existing low-temperature mobility measurements vary by a factor of 50 and appear to depend on the electron concentration used. Pulsed time-of-flight studies will be extended to lower temperatures and lower drift electric fields, and measurements made as a function of electron concentration, to help resolve this problem. In addition, studies of the mobility in the 'hot electron' regime will search for the striking non-linear behavior that has recently been predicted.

This is a renewal of DMR 7621342, the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0003, THEORETICAL RESEARCH IN PHYSICS OF HIGHLY IONIZED HEAVY ATOMS

D.W. Norcross, U.S. Dept. of Commerce, National Bureau of Standards, Astrophysics Div., Colorado Laboratory, *Boulder*, *Colorado* 80302

Use of a model potential approach to the calculation of energy levels and radiative transition probabilities for highly ionized heavy atoms are reported; calculations carried out for eight ions in the sodium isoelectronic sequence from Mg II through W LXIV. The technique involves the solution of the Dirac equation for the single outer valence electron, with a model central potential in the region of the atomic core; the effect of core polarization incorporated in the model potential. The results, for both energy levels and radiative transition probabilities, are encouraging and suggest that the model potentials and wave functions obtained will be quite satisfactory for subsequent calculations of electron impact excitation of these ions. (DOE/ER-0002)

SUPPORTED BY U.S. Dept. of Energy, Office of Energy Research

8.0004, LASING CHARACTERISTICS OF GAS MIXTURES INVOLVING UF6 APPLICATION TO NUCLEAR PUMPING OF LASERS

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SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

8.0005, ION IMPLANTATION IN PEROVSKITE TYPE FERROELECTRICS 14313-P

R. Gerson, University of Missouri, Rolla Campus, School of Arts & Sciences, Dept. of Physics, *103 Parker Hall*, *Rolla*, *Missouri* 65401 (DA0E9273; DAAG29 77 G0001)

To investigate the effect of ion implantation of ferroelectric crystals such as some of the standard barium titanate type materials and some electrooptic materials like lithium niobate, lithium tantalate and bismuth titanate. Relevance - there is a growing body of information which suggests that a good deal of the standard ferroelectric, piezoelectric, pyroelectric properties are, either in whole or in part, dependent on the surface properties of these materials. There are some arguments that suggest that modification of these surfaces would provide a whole new class of devices. Piezoelectrics are used as fuze initiators and pyroelectrics are used as IR detectors.

A broad range of perovskite-type ferroelectric materials will be implanted with hydrogen, oxygen, helium and p and n type metallic dopants. The properties of these materials will then be studied to evaluate some of their device potential.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

8.0006, ELECTRONIC STATES AT METAL-SEMICONDUCTOR INTERFACES

A.J. Sievers, Cornell University, Ithaca Campus, School of Arts & Sciences, Dept. of Physics, *Ithaca*, *New York* 14850 (DF053440; AFOSR-78-3684)

AF function - microwave solid state electronic devices are essential elements of Air Force surveillance, electronic countermeasures, and communication systems. Opportunity - little is known about the metal-semiconductor interface electronic states that produce the Schottky barrier and there have been only a few

techniques that could study these electronic states. Objective - the objective of this research is to study metal-semiconductor interface states using new IR techniques. How work contributes - this research should provide additional knowledge on the physical nature of interface electronic states that would indicate how these states could best be used in a new generation of submicron electrical and optical devices.

An IR surface electromagnetic wave spectrometer and a Fourier transform ellipsometer will be designed and constructed. The excitation spectrum of the electronic interface states will be examined for metal in contact with both group IV and III-V semiconductors with initial research on Ge-Au and Ge-Ag systems by measuring the surface electromagnetic wave absorption as a function of pressure, temperature, d.c. electric field and magnetic field.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0007, SURVEILLANCE - TWO-PHOTON ABSORPTION AND AMPLIFICATION IN GASES
L.M. Narducci, Drexel University, School of Science, Dept. of Physics & Atmospheric Science, *32nd & Chestnut Sts., Philadelphia, Pennsylvania* 19104 (DN775007; N00014-76-C-1082)

The Navy requires an improved understanding of potentially new types of lasers. This effort will address the requirements for producing lasers operating on two-photon transitions.

This effort will address three aspects of two-photon lasers: (1) the identification of an appropriate pumping scheme for producing an inversion between two levels of identical parity; (2) the observation of stimulated two-photon emission between atomic levels of the same parity; (3) an analysis of the potentially large number of competing processes whose end result will be the depletion of the useful population inversion between the two relevant levels. In particular, experimental studies will be carried out on atomic calcium. Calcium is somewhat unique in that the lowest excited states are metastable with respect to decay to the ground state. Calcium will be optically pumped from the singlet s(o) ground state to the singlet d(2) excited state through the higher 5 singlet p(1) and two-photon stimulated emission will be investigated from the singlet d(2) to the singlet s(o) transition at 4575 Angstroms using a 9150 Angstrom dye laser.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

SOCIAL SCIENCES

Includes Social Sciences (general); Administration and Management; Documentation and Information Science; Economics and Cost Analysis; Law and Political Science; and Urban Technology and Transportation.

9.0001, WESTERN INFLUENCES ON THE ASTRONOMY OF THE HOPI INDIANS - THE INTERPLAY OF TRADITIONAL AND MODERN SCIENCE
S.G. McCluskey, West Virginia University, School of Arts & Sciences, Dept. of History, *Morgantown, West Virginia* 26506 (SOC78-05768)

A series of recent studies has demonstrated the astronomical capabilities of the traditional science of 'primitive' peoples. Most of these studies, however, have failed to integrate traditional astronomy with the religious myths and rituals in which it is embodied.

Dr. McCluskey has recently published a study of the astronomical practices at one Hopi pueblo that begins to define a working system of traditional astronomy within its cultural context. He is now extending his analysis by using data from other villages where published data suggest significant differences, some due to European influences, are to be found. This study should resolve three questions by clarifying the astronomical and cosmological concepts underlying Hopi astronomy, separating the variable elements from the essential core of this tradition, and defining the historical changes of this tradition under internal tensions and the external pressures of a scientifically advanced culture. This last aspect transcends the Hopi and their astronomical tradition, and may lead to generalizations concerning how cultural contacts modify scientific ideas. For example, understanding the influence of European astronomy and culture upon the Hopi may contribute to an understanding of the influence of Roman science and culture upon the traditional astronomy of Northern Europe.

SUPPORTED BY U.S. National Science Foundation, Div. of Social Sciences

SPACE SCIENCES

Includes Space Sciences (general); Astronomy; Astrophysics; Lunar and Planetary Exploration; Solar Physics; and Space Radiation. For Related Information See Also Geosciences.

10.0001, 5 MICRON DETECTOR ASSEMBLIES STUDY FOR SHUTTLE INFRARED TELESCOPE FACILITY
G.H. Rieke, University of Arizona, School of Liberal Arts, Dept. of Astronomy, *Tucson, Arizona* 85721 (NAS 2-10227)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

10.0002, LOW SPECTRAL RESOLUTION OPTICAL SURVEY OF THE HEAO-B HIGH RESOLUTION IMAGER FIELDS
P.A. Strittmatter, University of Arizona, School of Liberal Arts, Dept. of Astronomy, *Tucson, Arizona* 85721 (NAS 8-33351)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Marshall Space Flight Center

10.0003, SPACE TELESCOPE/HIGH-RESOLUTION SPECTROGRAPH INTERSTELLAR MEDIUM STUDIES
M.A. Jura, University of California, Los Angeles Campus, School of Letters & Science, Dept. of Astronomy, *405 Hilgard Ave., Los Angeles, California* 90024 (NAS 5-25657)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0004, IONIZED GAS IN NEBULAE, GALAXIES, AND QUASARS
D.E. Osterbrock, University of California, Santa Cruz Campus, Lick Observatory, *Mount Hamilton, California* 95140 (AST7618440 A02)

Seyfert galaxies and radio galaxies, star systems in which large amounts of energy are released, will be studied spectroscopically using the Lick Observatory 120-inch telescope. Accurate quantitative spectra will be taken of these objects and analyzed to try to learn about the physical conditions, how the large velocities of the gas observed in these objects are maintained, and how the energy that makes them radiate light is fed into the gas. The measurements made with the spectral scanner on the telescope will be compared with theoretical calculations in an effort to test our ideas and, if possible, to find out observationally which of them can be narrowed down and better specified, and which can be eliminated from consideration. A more definite picture of the energy sources in galaxies will emerge.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0005, SOLAR FLARES AND COMMUNICATIONS
R.F. Howard, Carnegie Inst. of Washington, *1530 P St. N.W., Washington, District of Columbia* 20005 (DN723093; N00014-76-C-0113)

Naval communications, navigation, surveillance, and magnetic anomaly detection systems are degraded or completely disrupted by ionospheric and magnetospheric disturbances caused by solar flare activity. The primary goal of this program is to develop an adequate understanding of solar flares to allow prediction of flare activity and the resulting geomagnetic disturbances. Research is performed on the physical behavior of magnetic fields on the solar surface, on the formation of active regions, and on the effects on the interplanetary magnetic field.

Full disk magnetograms are produced from data collected at Mt. Wilson Observatory, and are analyzed to yield information on the magnetic field and bulk velocity distributions on the solar surface. These observations are used to predict solar flares, geomagnetic storms, and other solar-terrestrial effects. Research is performed on development of flares and solar active regions, on the large-scale magnetic field, and on the large-scale circulation of the solar atmosphere.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

10.0006, FOR OPERATION OF COSMIC
Unknown, University of Georgia, Graduate School, *Athens, Georgia* 30601 (NASW 3247)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Headquarters, NASA

10.0007, AN INVESTIGATION OF THE RELATION BETWEEN SEYFERT AND OTHER ACTIVE NUCLEI GALAXIES
A.S. Wilson, University of Maryland, Baltimore County Campus, Graduate School, *1420 N. Charles St., Catonsville, Maryland* 21201 (NAS 8-33358)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Marshall Space Flight Center

10.0008, VERY-LONG-BASELINE INTERFEROMETRY AT THE HARVARD RADIO ASTRONOMY STATION
G.B. Field, Harvard University, Cambridge Campus, School of Arts & Sciences, Dept. of Astronomy, *Cambridge Station, Cambridge, Massachusetts* 02138 (AST7826296)

Astronomical programs in very-long-baseline interferometry (VLBI) will be carried out at the Harvard Radio Astronomy Station (HRAS), Fort Davis, Texas. Because its location ideally complements the other radio telescopes in the VLBI Network, which tend to be concentrated on the East and West Coasts of the United States, HRAS, as a VLBI site, has unusual importance.

Astronomical VLBI observations will be carried out primarily at wavelengths of 2.8, 5, 6, and 18 cm. Continuum sources, such as quasars, that show angular structure in the milliarcsecond range will be observed periodically to monitor time changes in their angular structure. Spectral-line sources, such as OH masers that may originate in circumstellar envelopes around newly formed stars, will be studied in detail. We will do part of this research ourselves, and part of the effort will be in support of research programs by other scientists. Our primary goal is to support VLBI Network observations and other astronomical VLBI work.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0009, PORTABLE HIGH-SPEED PHOTOMETRY SYSTEMS FOR OBSERVING OCCULTATIONS
J.L. Elliot, Massachusetts Inst. of Technology, Graduate School, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (NSG 7526)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

10.0010, RADIO ASTRONOMY AT HAYSTACK OBSERVATORY
P.B. Sebring, Northeast Radio Observ. Corp., Haystack Observatory, *Westford, Massachusetts* 01886 (AST7818227)

VLBI experimentation and techniques continue as the most important in-house research activities. Haystack scientists are active in both continuum and spectral line VLBI experiments and serve as advisors on all visitor VLBI work. About 20% of Haystack observing time is used in astrometric, source structure and other studies by VLBI techniques. Haystack supports the VLBI Network both through regular allotments of time and in improving its coverage of Network wavelengths.

Most of the single-antenna observing time will be used for spectral line studies, including radiation from such molecules as NH3, H2O, CH3OH, SiO and certain heavy molecules, as well as extensive recombination line investigations, using low-noise front ends and the 1024-channel spectrometer. Continuum observations will include mapping and long-term observations of variable sources at several frequencies. Visiting scientists will conduct most of the research, time for which is allotted in response to written proposals approved by a committee.

Some 28 students are now doing, or have recently done, research involving Haystack. Four others have earned the Ph.D within the past year on the basis of research in which Haystack observations were important.

About 6000 hours of telescope time will continue to be devoted to radio astronomy observations (exclusive of maintenance, system tests, etc.) in each of the three years of this proposal.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0011, FLIGHT EXPERIMENTS - GAMMA-RAY BALLOON EXPERIMENT
G.G. Fazio, Smithsonian Institution, Astrophysical Observatory, *60 Garden St., Cambridge, Massachusetts* 02138

To study the emission of gamma radiation from celestial sources, a new type of detector, the gas-Cerenkov telescope, has been developed. Two versions of this detector, one in the 10-100 MeV region, the other in the region above 150 MeV (in conjunction with Cornell University), have been constructed and flown in high-altitude balloons to search for gamma rays from cosmic sources.

SUPPORTED BY Smithsonian Institution, Astrophysical Observatory

10.0012, STUDIES OF THE ATMOSPHERIC STRUCTURE OF PECULIAR EARLY-TYPE STARS
J.B. Lester, Smithsonian Institution, Astrophysical Observatory, Optical & Infrared Div, *60 Garden St., Cambridge, Massachusetts* 02138 (310-4050-09)

OBJECTIVE: Certain hot stars have spectral absorption lines which are either stronger or weaker than the majority of stars of the same spectral type. The conditions which produce these anomalous line strengths are largely unknown. The object of this work is to study representative peculiar stars in an attempt to determine these conditions. The conditions probably contain information about the atmospheric structures of evolving stars.

APPROACH: The approach is to make high-dispersion spectral observations of the program stars and to interpret these observations with model stellar atmosphere calculations.

PROGRESS: A number of stars have been observed with the Cassegrain echelle spectrograph at the Mt. Hopkins Observatory. Measurement of this material is being delayed pending the completion of modifications to the David Mann microphotometer.

FUTURE: Additional observations of more stars and observations of different spectral regions will be made during the coming year.

SUPPORTED BY Smithsonian Institution, Astrophysical Observatory

10.0013, NUCLEAR ASTROPHYSICS
H. Mitler, Smithsonian Institution, Astrophysical Observatory, *60 Garden St., Cambridge, Massachusetts* 02138 (31P-4P50-03)

Work on electron-ion screening in dense thermonuclear plasmas has been completed. Calculations have been made showing differences from standard expressions. The work has been extended to include dynamical effects, and this is being written up for publication.

Expressions are being worked out for the H and He cosmic-ray spectra.

Most of the current effort lies in elaborating a new theory of formation of the Moon via partial capture from a protomoon, so as to exclude its iron.

Investigations on the origin of the neutron fluxes for the s and r processes are proposed.

SUPPORTED BY Smithsonian Institution, Astrophysical Observatory

10.0014, ANALYSIS OF FLARE-STAR OBSERVATIONS
F.L. Whipple, Smithsonian Institution, Astrophysical Observatory, *60 Garden St., Cambridge, Massachusetts* 02138 (SFG 0 6425)

The Uttar Pradesh State Observatory (UPSO) in Naini Tal, India, is analyzing and reducing approximately 500 film exposures of suspected flare stars taken by Baker-Nunn cameras at eight SAO stations.

The reduction of the Baker-Nunn photographs is intended to yield brightness data on various flare stars, which, when combined with simultaneous radio-frequency observations and multicolor photoelectric observations, will result in information such as spectral-energy distribution, light curves, and total energy release of stellar flares.

SUPPORTED BY Smithsonian Institution, Office of Fellowships & Grants

10.0015, THE STRUCTURE AND COMPOSITION OF PLANETARY ATMOSPHERES
T.M. Donahue, University of Michigan, Ann Arbor Campus, School of Literature Science & the Arts, Dept. of Atmospheric & Ocenic Science, *Ann Arbor, Michigan* 48104 (ATM7819251)

This award will fund research leading to completion of analysis of the 1977 ultraviolet stellar occultation experiment from the Orbiting Astronomical Observatory 'Copernicus,' that seems to confirm very large 03 and NO densities in the tropical night time mesosphere. The photochemical significance of these results will also be investigated. A self-consistent, photochemical-radiative model will be constructed for the atmosphere of Titan.

A calculation of the steady state distribution of O2 in the prebiological atmosphere of earth will be performed, and the effect of adding O2 from biotic sources to this atmosphere will be studied.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

10.0016, NAVY ENVIRONMENT - SOLAR STORM INFLUENCE
G.D. Freier, University of Minnesota, Minneapolis Campus, School of Liberal Arts, Dept. of Physics & Astronomy, *322 Johnston Hall, Minneapolis, Minnesota* 55455 (DN923095; N00014-75-C-0193)

The aim of this research is to determine if tropospheric weather and climate are influenced through electrical coupling by the thunderstorm to solar events. If such a coupling exists, its recognition and use could improve the meteorological forecast for naval operations.

There now exists at the University of Minnesota a continuous record of eleven years duration to date of simultaneous observations of thunderstorms, lightning, precipitation and other meteorological parameters. These records are studied to show how they relate to periods of drought and excess precipitation, and how electrical activity varies with seasons, time of day, and with solar activity. These records now exist for about one-half of a solar cycle, give an excellent history of the electrical activity of a particular geographic location, and should reflect the solar-upper atmosphere-lower troposphere coupling that is presumed to exist.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

10.0017, SPECTROSCOPIC AND INFRARED STUDIES OF HERBIG-HARO OBJECTS
R.D. Schwartz, University of Missouri, St. Louis Campus, School of Arts & Sciences, Dept. of Physics, *8001 Natural Bridge Rd., St. Louis, Missouri* 63121 (AST7902787)

Herbig-Haro objects are peculiar nebulae which are found within the boundaries of dark clouds. These objects are strong infrared sources and are characterized by mass loss. It is believed that the infrared sources associated with some groups of Herbig-Haro nebulae are dust-embedded pre-main sequence stars.

This project will involve a twofold investigation of Herbig-Haro nebulae. First, high-dispersion spectrograms of the brightest nebulae will be obtained. The purpose will be to resolve the radial velocity structure within the relatively broad emission lines, structure which appears at the limit of previous spectrographic studies. This information may reveal the details of the gas dynamics within the objects, and allow discrimination between different theoretical models of the Herbig-Haro objects. Second, an infrared survey will be conducted to search for infrared sources in the vicinities of Herbig-Haro nebulae, and to determine the positions and luminosities of those sources which are detected. This research will help our understanding of mass loss in very young objects, an evolutionary stage in a star which is important in the understanding of our own Solar System.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0018, IRON-60 AS A HEAT SOURCE AND CHRONOMETER IN EARLY SOLAR SYSTEM
T.P. Kohman, Carnegie Mellon University, Mellon Inst. of Science, Dept. of Chemistry, *4400 5th Ave., Pittsburgh, Pennsylvania* 15213 (NSG 7585)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

10.0019, COSMOLOGICAL INVESTIGATIONS AT MICROWAVE AND OPTICAL WAVELENGTHS
R.B. Partridge, Haverford College, Graduate School, Dept. of Astronomy, *Haverford, Pennsylvania* 19041 (AST7680201 A01)

Observations will be carried out which may help to answer three important cosmological questions: What are the masses of clusters of galaxies (and the mean mass density of the Universe)? And finally, when do galaxies form, and what is their early evolution like?

A large part of the mass in and around clusters of galaxies may be in some form of intergalactic matter. Observations in the microwave region have set limits on the amount of ionized gas. Faint intergalactic starlight will be observed to determine the ratio of virial mass to luminosity for a number of galaxy clusters.

Observations will be carried out which will exploit the cosmological information contained in the angular variations in intensity of the cosmic microwave background radiation. Measurements of, or upper limits on, the isotropy and homogeneity of the Universe will be done making more sensitive measurements of the distribution of the cosmic microwave background on several angular scales.

A search for galaxies in the process of formation, at early epoch, and therefore large redshifts will be attempted.

This is a continuation of research supported by AST76-80201.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0020, DEVELOPMENT OF A COMPUTER CODE TO DETERMINE INTERACTIONS OF COSMIC RAYS WITH SPACECRAFT AND BIOLOGICAL MATERIALS
B.S. Shen, University of Pennsylvania, School of Arts & Sciences, Dept. of Astronomy, *34th & Spruce Sts., Philadelphia, Pennsylvania* 19104 (NAS 9-15789)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Johnson Space Center

10.0021, AN INNOVATIVE INFRARED DETECTOR
M.A. Gundersen, Texas Tech University, School of Engineering, Dept. of Electrical Engineering, *P.O. Box 4340, Lubbock, Texas* 79409 (ENG78-11731)

The primary objective of this research program is the development of a novel infrared upconversion device for detection. Important device features include good detectivity, high speed, good linearity, efficiency, wide range of sensitivity, high

damage threshold, and low noise. The operation of the device is based upon the principle of an infrared quantum counter. The following investigations are being conducted: (1) Pump wavelength dependence using an infrared source; (2) Signal wavelength dependence of the device; (3) Various device configurations; (4) Ultimate sensitivity of an infrared quantum counter; (5) Limits to internal conversion efficiency; (6) Devices for detection in the far infrared; (7) Further possible materials candidates.

The advance of detection capability in the near and far infrared provides for a new class of receivers in a relatively unused frequency band that can be used in communications, radio astronomy, and spectroscopy.

SUPPORTED BY U.S. National Science Foundation, Div. of Engineering

10.0022, SPACE TELESCOPE/HIGH-RESOLUTION SPECTROGRAPH

L.M. Trafton, University of Texas, Austin Campus, School of Natural Sciences, Dept. of Astronomy, *200 W. 21st St., Austin, Texas* 78712 (NAS 5-25656)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0023, SUPPORT OF HIGH-RESOLUTION SPECTROGRAPH (HRS)

B.D. Savage, University of Wisconsin, Madison Campus, School of Letters & Science, Dept. of Astronomy, *500 Lincoln Dr., Madison, Wisconsin* 53706 (NAS 5-25714)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

GENERAL

11.0001, HISTORY OF AMERICAN FLIGHT RESEARCH AND FLIGHT TESTING

R.P. Hallion, Smithsonian Institution, Science & Technology, *1000 Jefferson Dr. S.W., Washington, District of Columbia* 20560

The research represents an attempt to draw together research materials, pertinent documentation and historical accounts dealing with the emergence of flight testing and flight research. Emphasis will be concentrated on the 1920 to 1940 time span and will include examination of the role played by such agencies as the U.S. Army, U.S. Navy, NACA and the U.S. Bureau of Standards in the professionalization of the flight testing art.

This research is being conducted at a low level of effort starting with material obtained from the NACA Flight Research Center.

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Scientific and Technical Aerospace Reports

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01 AERONAUTICS (GENERAL)

N79-29138# Dayton Univ. Research Inst., Ohio.
PREDICTED CRACK REPAIR COSTS FOR AIRCRAFT STRUCTURES Final Technical Report, Jun. 1977 - Sep. 1978
Alan P. Berens Nov. 1978 83 p refs
(Contract F33615-77-C-0800)
(AD-A068699; ASD-TR-78-39) Avail: NTIS HC A05/MF A01 CSCL 01/3

This report presents the results of a study designed to (1) prepare a computer program for use in predicting expected repair costs of the cracks which develop during the operational usage of a structure; (2) to provide a document which describes the use of the computer program and guides a potential user in the specification of the required input; and (3) to use data which is reasonably representative of Air Force experience as input for use in determining the sensitivity of expected maintenance costs to variations in input. Results are provided which compare expected costs for changes in inspection intervals, quality of inspection, quality of repair, operational usage, and equivalent initial flaw size distributions. GRA

02 AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer.*

N79-29139 Washington Univ., Seattle.
THE INTERACTION BETWEEN e-BEAM SUSTAINED DISCHARGE AND SUPERSONIC FLOW Ph.D. Thesis
Eliyahu Margalith 1978 166 p
Avail: Univ. Microfilms Order No. 7917605

The transition to arc in static discharges is observed and compared to discharge breakdown in the flow. A difference in the performance limits of the two cases is shown and discussed. Density disturbances, resulting from the heat release in the cathode fall are examined and related to variations in the flow boundary layer on the cathode side. The time required to reach steady state is determined by monitoring the static pressure variation during the discharge. The volumetric heating of the flow by the discharge is found to be less important than the disturbances within the boundary layer for the observed discharge instability, and the measured increase in pressure. By removing the cathode from the existing boundary layer into the core flow, the power loading per unit volume increases by a factor of two. Dissert. Abstr.

N79-29140 Mississippi State Univ., State College.
NUMERICAL SOLUTION OF THE NAVIER-STOKES EQUATIONS FOR LAMINAR, TRANSONIC FLOWS Ph.D. Thesis
Louie Turner, III 1979 147 p
Avail: Univ. Microfilms Order No. 7918542

Time histories of the transonic laminar flow development about a circular cylinder and a NACA-0018 airfoil were obtained. Reynolds numbers ranged from those corresponding to purely laminar flow to Reynolds numbers corresponding to a significant region of turbulence in the boundary layer. Body thermal conditions of an adiabatic wall and a specified body temperature were considered. Computational results are presented in the form of velocity vector fields, Mach number contours, aerodynamic coefficients, heat transfer rates at the body surface and body temperature distributions. Truncation analyses of first and second derivative difference approximations were performed. These analyses resulted in general criteria for numerically generated coordinates so that flow near body is more accurately represented. Dissert. Abstr.

N79-29141*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
A COMPUTER PROGRAM FOR DETAILED ANALYSIS OF THE TAKEOFF AND APPROACH PERFORMANCE CAPABILITIES OF TRANSPORT CATEGORY AIRCRAFT
Willard E. Foss, Jr. Jun. 1979 38 p refs
(NASA-TM-80120) Avail: NTIS HC A03/MF A01 CSCL 01A

The takeoff and approarch performance of an aircraft is calculated in accordance with the airworthiness standards of the Federal Aviation Regulations. The aircraft and flight constraints are represented in sufficient detail to permit realistic sensitivity studies in terms of either configuration modifications or changes in operational procedures. The program may be used to investigate advanced operational procedures for noise alleviation such as programmed throttle and flap controls. Extensive profile time history data is generated and is placed on an interface file which can be input directly to the NASA aircraft noise prediction program (ANOPP). A.R.H.

N79-29142*# Flow Research, Inc., Kent, Wash.
THE DIRECT NUMERICAL SIMULATIONS OF THE TURBULENT WAKES OF AXISYMMETRIC BODIES Interim Report
James J. Riley and Ralph W. Metcalfe Mar. 1978 84 p refs
(Contract NAS2-9855)
(NASA-CR-152282; RR-135) Avail: NTIS HC A05/MF A01 CSCL 01A

Results of direct numerical simulations of turbulence are compared with both laboratory data and self-similarity theory for the case of the turbulent wakes of towed, axisymmetric bodies. In general, the agreement of the simulation results with both the laboratory data and the self-similarity theory is good, although the comparisons are hampered by inadequate procedures for initializing the numerical simulations. Author

N79-29143*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
RECENT APPLICATIONS OF THEORETICAL ANALYSIS TO V/STOL INLET DESIGN

Norbert O. Stockman 1979 18 p refs Presented at Workshop on V/STOL Aerodyn., Monterey, Calif. 16-18 May 1979; sponsored by Naval Air Develop. Center
(NASA-TM-79211; E-096) Avail: NTIS HC A02/MF A01 CSCL 01A

The theoretical analysis methods, potential flow, and boundary layer, used at Lewis are described. Recent application to Navy V/STOL aircraft, both fixed and tilt nacelle configurations, are presented. A three dimensional inlet analysis computer program is described and preliminary results presented. An approach to optimum design of inlets for high angle of attack operations is dicussed. M.M.M.

N79-29144*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
AERODYNAMIC CHARACTERISTICS OF A LARGE-SCALE SEMISPAN MODEL WITH A SWEPT WING AND AN AUGMENTED JET FLAP WITH HYPERMIXING NOZZLES
Thomas N. Aiken, Michael D. Falarski, and David G. Koenin Jul. 1979 87 p refs
(NASA-TM-73236; A-7013) Avail: NTIS HC A05/MF A01 CSCL 01A

The aerodynamic characteristics of the augmentor wing concept with hypermixing primary nozzles were investigated. A large-scale semispan model in the Ames 40- by 80-Foot Wind Tunnel and Static Test Facility was used. The trailing edge, augmentor flap system occupied 65% of the span and consisted of two fixed pivot flaps. The nozzle system consisted of hypermixing, lobe primary nozzles, and BLC slot nozzles at the forward inlet, both sides and ends of the throat, and at the aft flap. The entire wing leading edge was fitted with a 10% chord slat and a blowing slot. Outboard of the flap was a blown aileron. The model was tested statically and at forward speed. Primary parameters and their ranges included angle of attack from -12 to 32 degrees, flap angles of 20, 30, 45, 60 and 70 degrees, and deflection and diffuser area ratios from 1.16 to 2.22. Thrust coefficients ranged from 0 to 2.73, while nozzle pressure ratios varied from 1.0 to 2.34. Reynolds number per foot varied from 0 to 1.4 million. Analysis of the data indicated a maximum static, gross augmentation of 1.53 at a flap angle of 45 degrees. Analysis also indicated that the configuration was an efficient powered lift device and that the net thrust was comparable with augmentor wings of similar static performance. Performance at forward speed was best at a diffuser area ratio of 1.37. K.L.

N79-29145*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
SURFACE PRESSURE DATA ON A SERIES OF ANALYTIC FOREBODIES AT MACH NUMBERS FROM 1.70 TO 4.50 AND COMBINED ANGLES OF ATTACK AND SIDESLIP
James C. Townsend, Dorothy T. Howell, Ida K. Collins, and Clyde Hayes Jun. 1979 309 p refs
(NASA-TM-80062; L-12780) Avail: NTIS HC A14/MF A01 CSCL 01A

Tabulated surface pressure data for a series of four forebodies which have analytically defined cross sections and which are based on a parabolic arc profile having a 20 deg half angle at the nose are presented without analysis. The first forebody has a circular cross section, and the second has a cross section which is an ellipse with an axis ratio of 2/1. The third has a cross section defined by a lobed analytic curve. The fourth forebody has cross sections which develop smoothly from circular at the pointed nose through the lobed analytic curve and back to circular at the aft end. The data generally cover angles of attack from -5 deg to 20 deg at angles of sideslip from 0 deg to 5 deg for Mach numbers of 1.70, 2.50, 3.95, and 4.50 at a constant Reynolds number. Author

N79-29146*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
AN EXPERIMENTAL AND THEORETICAL INVESTIGATION OF THE EFFECT OF NONMETRIC OVER-THE-WING NACELLES ON WING-BODY AERODYNAMICS
David E. Reubush Aug. 1979 79 p refs
(NASA-TP-1503; L-13010) Avail: NTIS HC A05/MF A01 CSCL 01A

Drag reduction benefits due to blowing the jet exhausts over the wing for a transport-type wing-body configuration were investigated in the Langley 16-foot transonic tunnel. A combination of a wing-body model and a powered-nacelle test rig was tested at Mach numbers of 0.50 and 0.80 at angles of attack from -2 degrees to 4 degrees and jet total-pressure ratios from jet off to 3 or 4 (depending on Mach number) for a variety of nacelle locations relative to the wing. The experimental results were compared with the predictions obtained from several theoretical techniques. It was concluded that positioning of the nacelles (nonmetric) can have large effects on the wing-body drag. Some positions yielded higher drag than the baseline position, whereas others yielded lower drag than the baseline position. The theoretical method which utilized a quasi-vortex-lattice for the wing and wing-jet interaction in combination with a jet entrainment model gave generally reasonable predictions of the drag increments. M.M.M.

N79-29147# Spectron Development Labs., Inc., Costa Mesa, Calif.
COMPARISON OF DATA FROM THE TRANSIT TIME VELOCIMETER WITH OTHER SYSTEMS NOW IN USE FOR VELOCITY MEASUREMENTS Final Report, Jan. - Sep. 1978
W. T. Mayo, Jr. and A. E. Smart May 1979 89 p refs
(Contract F40600-78-C-0002)
(AD-A069096; AEDC-TR-79-32) Avail: NTIS HC A05/MF A01 CSCL 20/4

This report discusses the principles of operation of the laser transit anemometer (LTA), developed and constructed under this contract, and its use with a photon correlator. AEDC developed an electronic processor for fringe laser velocimeter systems. A test was conducted in a free jet with a stationary Mach disc to compare the sensitivity of the new processor with the older Model 8 burst-counter processor with respect to small-particle relaxation behind a shock front. The LTA combined with the photon correlator produced acceptable velocity data. Flare light can be most satisfactorily rejected by well-considered geometrical design and attention to optical components. The transit configuration allows at least an order to magnitude improvement in the proximity to walls at which good measurements may be made. The capabilities of the transit system to look at smaller particles and measure stresses by spot radiation are especially useful close to walls. GRA

N79-29148# ARO, Inc., Arnold Air Force Station, Tenn.
VERIFICATION TEST OF THE AEDC HIGH ALPHA ROLL DYNAMICS SYSTEM Final Report
J. A. Collins AEDC Nov. 1978 36 p refs
(AD-A068327; AEDC-TSR-78-p50) Avail: NTIS HC A03/MF A01 CSCL 20/4

A test was conducted to evaluate the new AEDC High Alpha Roll Dynamics System for large models and obtain scaling parameter information. Data were obtained at Mach numbers 0.22 thru 1.15 for a Reynolds number per ft range of 690,000 through 2,500,000, at angles of attack -5 to 25 deg, and spin rates up to approximately ten thousand RPM. The model configurations (L/D of 10, D = 4.5 in.) included the Basic Finner and the Modified Basic Finner. Instrumentation included a new four-component balance, tachometer, brake pad thermocouple and a microprocessor-based controller for the turbine/clutch/brake sequencing and for interfacing with the PWT computer system. GRA

N79-29149# ARO, Inc., Arnold Air Force Station, Tenn.
WING/STORE FLOW-FIELD MEASUREMENTS AT TRANSONIC SPEEDS USING A LASER VELOCIMETER Final Report, 18 Apr. 1977 - 30 Sep. 1978
F. L. Heltsley and V. A. Cline AEDC Apr. 1979 62 p refs
(AD-A068328; AEDC-TR-79-5) Avail: NTIS HC A04/MF A01 CSCL 01/3

A test was conducted in the AEDC Aerodynamic Wind Tunnel (1T) of the Propulsion Wind Tunnel Facility (PWT) to measure the flow fields about 5-percent models of several wing/store configurations. Test models included a wall-mounted swept wing and MK-83 and M-117 stores. Flow-field velocity measurements, made using a 2-component laser velocimeter, are presented together with model surface pressures and shadowgraphs. GRA

N79-29150# Goodyear Aerospace Corp., Akron, Ohio.
GOODYEAR AEROSPACE CONCEPTUAL DESIGN MARITIME PATROL AIRSHIP ZP3G Final Report
N. D. Brown 1 Apr. 1979 65 p refs
(Contract N62269-78-M-4580)
(AD-A068449; GER-16607; NADC-780-75-60) Avail: NTIS HC A04/MF A01 CSCL 01/3

A conceptual design of a modern technology airship with precision hover capability for use in maritime patrol is described. The size and major characteristics are established by a series of United States Coast Guard missions set forth by the contracting agency. GRA

N79-29151# Sandia Labs., Livermore, Calif. Applied Mathematics Div.
CHUTE: A COMPUTER CODE FOR CALCULATING THE GEOMETRICAL CONFIGURATION OF A LIFTING PARACHUTE
D. L. Mitchell Mar. 1979 41 p
(Contract EY-76-C-04-0789)
(SAND-78-8056) Avail: NTIS HC A03/MF A01

To minimize the asymmetries of slanted ribbon lifting parachutes, and thus minimize their tendency to roll, the computer program CHUTE was developed that numerically defines the geometrical configuration of a given lifting parachute. This information is used by a numerically controlled milling machine to create templates for making the parachute components. The program compensates for sewing take-up, elongation while being marked under a load, marking tolerances, and variances in the material dimensions. Parachutes fabricated using this technique exhibit improved roll characteristics compared with previous parachutes. DOE

N79-29152# Sandia Labs., Albuquerque, N. Mex.
REAL-TIME ESTIMATION OF AERODYNAMIC COEFFICIENTS BY MEANS OF AN EXTENDED KALMAN FILTER
J. R. Kelsey Feb. 1979 156 p refs
(Contract EY-76-C-04-0789)
(SAND-78-2032) Avail: NTIS HC A08/MF A01

A technique for estimation of the aerodynamic parameters of a flight vehicle from onboard measurements is presented. An extended Kalman filter is used to extract the parameters in the presence of measurement noise and initial uncertainty of the parameter values. Computer generated data were used for the measurement information in lieu of actual flight data. Several state models of varying complexity were studied in an attempt to find a model which yields adequate estimates while minimizing the required computation time. DOE

N79-29153# Los Alamos Scientific Lab., N. Mex.
DETERMINATION OF VEHICLE ROLLING RESISTANCE AND AERODYNAMIC DRAG
D. K. Lynn, J. B. McCormick, R. E. Bobbett, C. R. Derouin, J. Nachamkin, and W. Kerwin 1979 5 p ref Presented at the 29th Vehicular Technol. Conf., Arlington, Ill., 28-30 Mar. 1979
(Contract W-7405-eng-36)
(LA-UR-78-3229; Conf-790303-3) Avail: NTIS HC A02/MF A01

The retarding forces on the vehicles tested were characterized by rolling resistance and aerodynamic drag. These forces determine power requirements for a specified vehicle performance (particularly important for an electric vehicle) and are necessary inputs for any vehicle simulation. The forces are determined for a number of vehicles and the testing and data analysis techniques are described. DOE

N79-29154# Royal Aircraft Establishment, Farnborough (England). Aerodynamics Dept.
AN EXTENSION TO THE METHOD OF GARABEDIAN AND KORN FOR THE CALCULATION OF TRANSONIC FLOW PAST AN AEROFOIL TO INCLUDE THE EFFECTS OF A BOUNDARY LAYER AND WAKE
M. R. Collyer Jul. 1978 93 p refs Previously announced as RAE-TR-77104; ARC-37680
(ARC-R/M-3828; BR66513) Avail: NTIS HC A05/MF A01; HMSO £8

A numerical method was developed for calculating compressible (including transonic) flow past a single airfoil with an allowance for viscous effects, providing that the boundary layer is fully attached over the airfoil surface. This method was developed by combining an iterative scheme for the inviscid flow, originally established by Garabedian and Korn, with an integral method (the lag entrainment method of Green et al) for the calculation of compressible turbulent boundary layers. The inviscid scheme was modified to incorporate a boundary condition on the airfoil surface, which is imposed on the velocity normal to the surface, with a corresponding boundary condition for the wake. Wake curvature effects are also included. An iterative procedure is established, which iterates between successive calculations of the pressure distribution and of the displacement thickness of the boundary layer and wake. Results are presented from a computer program (VGK) and comparisons are made with experimental measurements and other theoretical results. Author (ESA)

N79-29155# Cambridge Univ. (England). Dept. of Engineering.
THE AERODYNAMIC NOISE OF A SLOT IN AN AEROFOIL
M. S. Howe Aug. 1977 45 p refs Previously announced as RAE-TR-77129; ARC-37794
(ARC-R/M-3830; BR66512) Avail: NTIS HC A03/MF A01

A theoretical investigation of the noise generated when turbulence interacts with a slot between a wing and a flap is described. The slot is modeled by the region between two overlapping, semi-infinite rigid planes representing the wing and flap. Sound is produced when turbulence convects above, below or through the slot. The analysis determines the dependances of the radiated sound on the characteristics turbulence velocity, the effect of forward flight on the field shape, and properties of the field radiated to the side of the aircraft flight path. Results indicate that above-the-wing-turbulence generates a monopole field in the flyover plane which is amplified in forward flight. For acoustic frequencies less than half that of the lowest resonant frequency of the slot the radiation is that of a monopole source whose intensity varies. Sideline noise exhibits dipole characteristics except at frequencies less than half the lowest resonance frequency of the slot, or at high sideline angles. Author (ESA)

03 AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation*.

N79-29156# Aerospace Engineering Test Establishment, Cold Lake (Alberta).
CH-113 CRASH POSITION INDICATOR FLIGHT TRIALS
K. D. Nelson 5 Mar. 1979 35 p refs Original contains color illustrations
(AETE-78/39) Avail: NTIS HC A03/MF A01

Tests were performed on the crash position indicator (CPI) installed on a CF CH-113 Labrador aircraft to determine the safe deployment envelope and the effect of CPI fitment on the flying qualities of the CH-113. The tuft predictions of CPI airfoil separation and trajectory were validated. Author

N79-29157# National Transportation Safety Board, Washington, D. C.
AIRCRAFT ACCIDENT REPORT: ROCKY MOUNTAIN AIRWAYS, INC., DEHAVILLAND DHC-6-300, N24RM, CHEYENNE, WYOMING, 27 FEBRUARY 1979
19 Jul. 1979 30 p
(NTSB-AAR-79-10) Avail: NTIS HC A03/MF A01

About 0807 mountain standard time, Rocky Mountain Airways, Inc., Flight 801, crashed into rolling terrain shortly after takeoff in visual flight conditions from runway 34 at Cheyenne Municipal Airport, Wyoming. The aircraft came to rest about 1.3 nmi east of the departure end of the runway. There were 14 passengers and a crew of 2 aboard; 2 passengers were

injured slightly. The aircraft was damaged substantially. The National Transportation Safety Board determined that the probable cause of the accident was the flightcrew's erroneous determination that the aircraft was not capable of single-engine flight and their actions which precluded obtaining maximum available performance from the aircraft. The cause of the engine failure was an erroneous assessment by company maintenance personnel of damage sustained by the right engine during an overtemperature condition and their poor judgment in deciding to repair and release the engine for flight without replacing the engine's power turbine section. Author

N79-29158# National Transportation Safety Board, Washington, D. C.
AIRCRAFT ACCIDENT REPORT: CONTINENTAL AIR LINES, INC., BOEING 727-224, N32725, TUCSON, ARIZONA, 3 JUNE 1977
1 Aug. 1978 43 p refs
(NTSB-AAR-78-9) Avail: NTIS HC A03/MF A01

The aircraft was damaged substantially after striking the powerlines and utility poles, which were located about 130 feet to the left of the runway centerline and about 710 feet from the departure end of the runway. The aircraft was landed safely at the Tucson Airport; there were no injuries. The National Transportation Safety Board determines that the probable cause of the accident was the captain's decision to take off under evident hazardous wind conditions which resulted in an encounter with severe wind shear and subsequent collision with obstacles in the takeoff path. The rate of climb of the aircraft in these conditions when flown according to prescribed operating procedures was not sufficient to clear the obstacles. If the aircraft's full aerodynamic capability was used, collision with obstacles probably could have been avoided. S.E.S.

N79-29159# National Transportation Safety Board, Washington, D. C.
AIRCRAFT ACCIDENT REPORT: UNITED AIRLINES, INC., DOUGLAS DC-8-54, N8047U NEAR KAYSVILLE, UTAH, 18 DECEMBER 1977
27 Jul. 1978 48 p
(NTSB-AAR-78-8) Avail: NTIS HC A03/MF A01

About 0138 m.s.t. on December 18, 1977, a United Airlines, Inc., DC-8F-54 cargo aircraft, operating as Flight 2860, crashed into a mountain in the Wasatch Range near Kaysville, Utah. The three flightcrew members, the only persons aboard the aircraft, were killed, and the aircraft was destroyed. Flight 2860 encountered electrical system problems during its descent and approach to the Salt Lake City Airport. The flight requested a holding clearance which was given by the approach controller and accepted by the flightcrew. The flight then requested and received clearance to leave the approach control frequency for a little minute to communicate with company maintenance. Flight 2860 was absent from the approach control frequency for about 7 1/2 minutes. During that time, the flight entered an area near hazardous terrain. The approach controller recognized Flight 2860's predicament but was unable to contact the flight. When Flight 2860 returned to approach control frequency, the controller told the flight that it was too close to terrain on its right and to make a left turn. After the controller repeated the instructions, the flight began a left turn and about 15 seconds later the controller told the flight to climb immediately to 8,000 feet. Eleven seconds later, the flight reported that it was climbing from 6,000 feet to 8,000 feet. The flight crashed into a 7,665-foot mountain near the 7,200-foot level. The National Transportation Safety Board determines that the probable cause of this accident was the approach controller's issuance and the flightcrew's acceptance of an incomplete and ambiguous holding clearance in combination with the flightcrew's failure to adhere to prescribed impairment-of-communications procedures and prescribed holding procedures. The controller's and flightcrew's actions are attributed to probable habits of imprecise communication and of imprecise adherence to precedures developed through years of exposure to operations in a radar environment. Contributing to the accident was the failure of the aircraft's No. 1 electrical system for unknown reasons. Author

N79-29160# National Transportation Safety Board, Washington, D. C.
AIRCRAFT ACCIDENT REPORT: ALASKA AERONAUTICAL INDUSTRIES, INC., DEHAVILLAND DHC-6-200, N563MA, NEAR ILIAMNA, ALASKA, 6 SEPTEMBER 1977
4 May 1978 31 p
(NTSB-78-5) Avail: NTIS HC A03/MF A01

On September 6, 1977, Alaska Aeronautical Industries, Inc. Flight 302 crashed into a glacier on the southwest side of Mt. Iliamna, Alaska, about 7,000 feet above mean sea level. The aircraft crashed in level flight in instrument meteorological conditions while en rouge from Iliamna, Alaska, to Anchorage, Alaska. There were two crewmenbers and eleven passengers aboard the aircraft; there were no survivors. The aircraft was destroyed. Because of the rapidly changing environmental conditions on the glacier face, recovery of bodies or wreckage was not possible. The National Transportation Safety Board has determined that the probable cause of the accident was the failure of the flightcrew to use proper navigational procedures for the route to be flown, especially their failure to use the available backup means of navigation to verify the position and the progress of the flight. Author

N79-29161# National Transportation Safety Board, Washington, D. C.
AIRCRAFT ACCIDENT REPORT: NATIONAL JET SERVICES, INC., DOUGLAS DC-3, N51071, EVANSVILLE DRESS REGIONAL AIRPORT, INDIANA, 13 DECEMBER 1977
17 Aug. 1978 52 p refs
(NTSB-AAR-78-10) Avail: NTIS HC A04/MF A01

Results of an aircraft accident investigation of a Douglas DC-3, operated as a passenger charter flight to transport the University of Evansville basketball team and associated personnel from Evansville, Indiana, to Nashville, Tennessee are reported. The probable cause of the accident was an attempted takeoff with the rudder and right aileron control locks installed, in combination with a rearward center of gravity, which resulted in the aircraft's rotating to a nose-high attitude immediately after takeoff and entering the region of reversed command from which the pilot was unable to recover. Contributing to the accident was the failure of the flight crew to insure that the passenger baggage was loaded in accordance with the configuration contained on the load manifest. Their failure resulted in a rearward center of gravity that was aft of the optimum range, but forward of the rearmost limit. A.W.H.

N79-29162# Committee on Commerce, Science, and Transportation (U. S. Senate).
AVIATION SAFETY
Washington GPO 1978 163 p refs Joint hearing before the Comm. on Commerce, Sci., and Transportation and the Comm. on Public Works and Transportation, 95th Congr., 2d Sess., 27 Oct. 1978
(GPO-37-810) Avail: Comm. on Commerce, Sci. and Transportation

Midair collisions and the systems improvements which will reduce the potential of these accidents are examined. Changes in procedures and standards that can help prevent a potential accident are emphasized. Specifically, the topics addressed are: (1) the air traffic control procedures after a conflict alert; (2) the requirement for positive control at more major air carrier airports; (3) the development and installation of both ground-based and airborne collision avoidance systems and what can be done to accelerate the introduction of that safety hardware; and (4) the issue of accelerating the implementation of reliever airports to provide incentives for reducing the mix of general aviation and air carriers at major airports. J.M.S.

N79-29163# Payne, Inc., Annapolis, Md.
WIND TUNNEL TEST OF ACES 2 EJECTION SEAT WITH ANTHROPOMETRIC DUMMY IN ASYMMETRIC CONFIGURATIONS Final Report, 15 Sep. 1976 - 30 Sep. 1978
Fred W. Hawker and Peter R. Payne Wright-Patterson AFB, Ohio AMRL Jan. 1979 53 p refs
(Contract F33615-76-C-0530; AF Proj. 7231)
(AD-A068614; Working-Paper-210-2; AMRL-TR-78-108) Avail: NTIS HC A04/MF A01 CSCL 01/2

Previous investigations have determined the aerodynamic forces and moments acting upon an open ejection seat and its occupant when the seat occupant was sitting symmetrically with

respect to the seat axes, with his limbs in the correct 'stowed' positions. The present investigation was undertaken to determine the changes in the aerodynamic forces due to deviations from this ideal position; principally off-center asymmetry and changes to limb movement. GRA

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Spacecraft Communications, Command, and Tracking* and *32 Communications.*

N79-29164# Stanford Telecommunications, Inc., McLean, Va.
INVESTIGATION OF A PRELIMINARY GPS RECEIVER DESIGN FOR GENERAL AVIATION Final Report
B. D. Elrod and F. D. Natali Los Angeles AFS SAMSO 14 Jul. 1978 132 p refs
(Contracts F04701-75-C-0239; DOT-FA77WAI-37)
(AD-A069059; STI/E-TR-8022; SAMSO-TR-79-34) Avail: NTIS HC A07/MF A01 CSCL 17/7

The preliminary design and analysis of a potentially low cost GPS receiver for general aviation navigation applications is presented. The results indicate that the receiver could meet or exceed 2D area navigation (RNAV) requirements without dependence on external altitude data. GRA

N79-29165# Litton Systems, Inc., Woodland Hills, Calif. Guidance and Control Systems Div.
NUCLEAR MOMENT ALIGNMENT, RELAXATION AND DETECTION MECHANISMS Annual Technical Report, Feb. 1978 - Jan. 1979
Charles H. Volk Mar. 1979 69 p refs
(Contract F49620-77-C-0047)
(AD-A069024; G/CSD-TR-404312; AFOSR-79-0599TR) Avail: NTIS HC A04/MF A01 CSCL 17/7

The reported physics research is part of an overall program to develop a nuclear magnetic resonance gyro that makes use of an optically pumped alkali metal vapor both to align the magnetic moments of noble gas nuclei and to detect the weak magnetic fields that are generated by the precession of these nuclear moments. A model for the role of the alkali-atom-noble-gas-atom Van der Waals molecule in the alkali electronic, noble gas nuclear spin exchange process has been developed. It has been found that spin exchange in the presence of the molecular formation is significantly more efficient than that for simple fly-by collisions. Preliminary experimental results have verified the general features of the molecular model. The theory for the quadrupole relaxation of noble gas nuclei in wall collisions has been developed. Experimental studies of krypton nuclear relaxation revealed a decay mode which was a function of the angular orientation of the cell in the apparatus and which was found to lead to a non-exponential type of decay signal. The model of the noble gas quadrupolar relaxation was found to explain all observations in the krypton experiments. GRA

N79-29166# Center for Naval Analyses, Arlington, Va. Operations Evaluation Group.
THE COMPUTATION OF TIME DIFFERENCE ERROR PROBABILITIES
Peter J. Butterly Jan. 1979 26 p refs
(Contract N00014-76-C-0001)
(AD-A068667; CRC-365) Avail: NTIS HC A03/MF A01 CSCL 17/7

In many naval systems position is estimated from multiple time differences. System accuracy is thus dependent on the errors in these quantities. Time differences, however, are not quantities for which adequate error information is generally available or readily ascertained experimentally. Instead, it is derived from a knowledge of the errors in the component times from which the differences are formed. In this research contribution, a formal treatment of the time yield time difference transformation is developed for the case where differences are formed with respect to a single time. The effect of changing this reference is investigated and expressions for computing error probabilities for multiple time differences are derived under conditions related to current applications. GRA

N79-29167# Defence Research Establishment Valcartier (Quebec).
AREA CORRELATION TECHNIQUES IN REMOTELY PILOTED VEHICLE GUIDANCE
C. Munteanu and G. Trottier Mar. 1979 32 p refs
(AD-A068702; DREV-R-4134/79) Avail: NTIS HC A03/MF A01 CSCL 17/7

Area correlation techniques are applied to the long-range remotely piloted vehicle (RPV) attack mission in both mid-course and terminal guidance phases. The mid-course guidance consists of a set of navigation fixes at waypoints along a pre-programmed route. The terminal guidance for weapon delivery incorporates a technique of compensation for magnification during range closure via a zoom lens. This report also presents simulations of both phases of guidance, using the sequential similarity detection algorithm as the image correlator. GRA

N79-29168# Aerospace Corp., El Segundo, Calif. Satellite Systems Div.
THE SHORT-TERM QUALITY OF NAVSTAR TRACKING DATA Final Report
P. S. Jorgensen Sep. 1978 32 p
(Contract F04701-78-C-0079)
(AD-A068238; TR-0079(4475-01)-1; SAMSO-TR-79-28) Avail: NTIS HC A03/MF A01 CSCL 17/7

For several months, two Navstar satellites have been intensively tracked by three monitor stations located in California, Hawaii and Alaska. Analysis of this tracking data shows that its short-term quality is high. This report discusses the tracking data, a technique for analyzing the data, and the results of this analysis. The application of this technique to evaluate the performance of atomic frequency standards in the satellite is presented. The effect of two-frequency ionospheric correction on the short-term quality of the tracking data is also discussed. GRA

N79-29169# Electronics Research Lab., Adelaide (Australia).
A NOTE ON PHASE VELOCITIES FOR VLF NAVIGATION
K. J. W. Lynn Jun. 1978 26 p refs
(AD-A068373; ERL-0016-TR) Avail: NTIS HC A03/MF A01 CSCL 17/7

The accuracy of long range VLF navigation systems depends ultimately on the development of phase propagation corrections which will allow for the geophysical variability of VLF phase velocity. Some preliminary estimates of phase velocities likely to be relevant Omega users in and around Australia are presented, as gleaned from the literature. Some likely areas of investigation which may lead to improvements in these values are described. GRA

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics.*

N79-29170# Aerospace Engineering Test Establishment, Cold Lake (Alberta).
CH-147 EMC EVALUATION OF SELECTED SUBSYSTEMS, EMC TEST REPORT
R. A. Lagrange 17 May 1979 16 p refs
(AETE-77/16-4) Avail: NTIS HC A02/MF A01

An electromagnetic interference/compatibility investigation was performed on the CH 147005 Chinook helicopter fitted with a high intensity anti-collision strobe light, a crash position indicator, and Omega Navigation system in order to (1) identify the cause of EMI problems detected during category 1 tests; (2) determine the EMC of the three newly installed avionics systems; and (3) develop and evaluate possible corrective action

for eliminating or reducing EMI/C problems. The methods used and results obtained are described. A.R.H.

N79-29171*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
FRICTION AND WEAR CHARACTERISTICS OF WIRE-BRUSH SKIDS
Robert C. Dreher Aug. 1979 30 p refs
(NASA-TP-1495; L-13095) Avail: NTIS HC A03/MF A01 CSCL 01C

The testing technique consisted of towing the skids with a ground test vehicle over asphalt and concrete surfaces at ground speeds up to 80 km/hr (50 mph) and bearing pressures up to 689 kPa (100 psi) over sliding distances up to 1585 m (5200 ft). Results indicate that the friction coefficient developed by wire brush skids is essentially independent of ground speed, is slightly increased with increasing bearing pressure, is noticeably affected by surface texture, and is not degraded by surface wetness. Skid wear is shown to increase with increasing bearing pressure and with increasing ground speed and is dependent on the nature of the surface. Runway surface damage caused by the skids was in the form of an abrasive scrubbing action rather than physical damage. S.E.S.

N79-29172# Lockheed Missiles and Space Co., Sunnyvale, Calif.
AQUILA REMOTELY PILOTED VEHICLE SYSTEM TECHNOLOGY RPV-STD PROGRAM. VOLUME 3: FIELD TEST PROGRAM Final Technical Report, Dec. 1974 - Dec. 1977
John A. Nicoletti Apr. 1979 284 p
(Contract DAAJ02-75-C-0005)
(AD-A068435; LMSC-D458287-Vol-3; USARTL-TR-78-37C) Avail: NTIS HC A13/MF A01 CSCL 01/3

System refinement and demonstration, and final Army crew training was accomplished at Fort Huachuca, Arizona, in 1976. The program required 28 flights and demonstrated major system functions prior to Army flight mission exercises to assess the system. The system proved most effective for surveillance and targeting. GRA

N79-29173# Rockwell International Corp., El Segundo, Calif.
AIRCRAFT TRANSPARENCY FAILURE AND LOGISTICAL COST ANALYSIS. VOLUME 2: DESIGN DATA AND MAINTENANCE PROCEDURES Final Report, Jun. 1977 - Sep. 1978
S. S. Brown Dec. 1978 151 p refs
(Contract F33615-77-C-3060; AF Proj. 2402)
(AD-A068720; NA-78-604-Vol-2; AFFDL-TR-78-153-Vol-2) Avail: NTIS HC A08/MF A01 CSCL 01/3

The aircraft transparency and logistical cost analysis program is aimed at reducing the logistical costs associated with transparency systems for 20 of the current Air Force inventory aircraft. The approach for achieving this goal was to collect all information relating to the physical and performance characteristics, and maintenance historical data of the selected study aircraft. These data provide the means of initiating search for design improvement and cost reduction studies. In order to assess the maintenance and logistical support activity as currently being practical at the Air Logistics Centers and Air Force Operational Bases, both maintenance and installation procedures, as well as qualification and testing procedures, for transparency components and support systems were collected. These data were assembled to determine the support structure level of effort and costs to identify those procedures and practices where cost reduction may be achieved. These data plus the failure analysis conducted in the transparency analysis phases provided the basis for implementing the design improvement and cost reduction studies shown in volume 3. GRA

N79-29174# Rockwell International Corp., El Segundo, Calif.
AIRCRAFT TRANSPARENCY FAILURE AND LOGISTICAL COST ANALYSIS. VOLUME 3: TRANSPARENCY ANALYSIS Final Report, Jun. 1977 - Sep. 1978
S. S. Brown Dec. 1978 215 p refs
(Contract F33615-77-C-3060; AF Proj. 2402)
(AD-A068721; NA-78-604-Vol-3; AFFDL-TR-78-153-Vol-3) Avail: NTIS HC A10/MF A01 CSCL 01/3

The Rockwell Maintenance Analysis Model (MAM) program was used to extract cost data from the K051 LSC system, and maintenance failure modes from the AFM 66-1 maintenance data collection system in order to conduct a detailed logistical cost and failure analysis. The cost and maintenance frequencies were utilized to pinpoint the most productive areas for life cycle cost reduction. A number of potential improvement studies were identified in the initial phase of this program. However, the effort required to research, analyze, and assemble these data, limited the development to five design improvement studies. These factors, coupled with the relative importance of the aircraft in the Air Force inventory, initiated the search for concepts that would cure or substantially reduce the failures identified in the above noted MAM's process. The verification of the feasibility of the proposed changes was accomplished by trading the projected 10-year life cycle cost of the existing concept to the costs of the development, refurbishing, and the reduced maintenance for the revised concept. The five design improvement trade studies resulted in significantly reduced logistical support costs. GRA

N79-29175# Science Applications, Inc., Englewood, Colo.
FLIGHT TEST ORIENTED PRECOMPILER SYSTEM (FLTOPS) DESIGN SPECIFICATIONS Final Report, May 1977 - Aug. 1978
Dean A. Otey, H. R. Ramsey, and John K. Willoughby Edwards AFB, Calif. AFFTC 28 Aug. 1978 320 p refs
(Contract F04611-77-C-0040)
(AD-A068394; SAI-78-061-DEN; AFFTC-TR-78-22) Avail: NTIS HC A14/MF A01 CSCL 01/3

FLTOPS is a tool to assist in setting up a generalized software system to meet the needs of a project. A simple and meaningful interface between the engineer and FLTOPS is provided. Based on engineer supplied input, FLTOPS generates code which will in essence be a generalized software system, however, it will be tailored to project requirements. GRA

N79-29176# Naval Postgraduate School, Monterey, Calif.
AN ANALYSIS OF BOLTER-HOLE SPACING IN AIRCRAFT CARRIER LANDINGS
Kneale T. Marshall May 1978 54 p ref
(AD-A068585; NPS55-78-013) Avail: NTIS HC A04/MF A01 CSCL 01/2

This paper presents an analysis of aircraft landing strategies on aircraft carriers. Optimal bolter-hole spacings are determined for various measures of effectiveness, and a short discussion is included on the use of automatic landing systems. GRA

N79-29177# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
THE EFFECT OF WINGLETS ON THE KC-135A AIRCRAFT Final Report, Jun. 1975 - Oct. 1977
George W. Loptien Nov. 1978 118 p refs
(AF Proj. 2404)
(AD-A068324; AFFDL-TR-78-124) Avail: NTIS HC A06/MF A01 CSCL 01/3

To investigate the effects of winglets on the aerodynamic characteristics of the KC-135 aircraft, semispan and full-span wind tunnel models with winglets have been investigated in the NASA/LRC 8-Foot Transonic Pressure Tunnel. At cruise conditions, the full-span tests indicated a total drag reduction of 5.3 percent for the model with the Boeing and NASA upper plus lower winglet configurations and 6.5 percent for the model with the NASA upper winglet configuration. A wing-tip-extension configuration tested on the semispan model had a drag reduction of about 3 percent compared to about 5 to 7 percent for the winglet configurations, however, the tip extension was not optimized for drag reduction. At cruise conditions, the wing tip extension produced the greatest increase in wing root bending moment and the upper winglets the least. The increase in wing root bending moment at cruise conditions varied from about 2.5 percent with the Boeing winglets, to about 3.5 percent with the tip extension. At cruise flight conditions, winglets on the KC-135A aircraft were estimated to reduce the drag about 8.2 percent and increase the maximum lift-drag ratio about 9.5 percent. GRA

N79-29178# Army Aviation Engineering Flight Activity, Edwards AFB, Calif.
PRELIMINARY AIRWORTHINESS EVALUATION RU-21 H GUARDRAIL V AIRCRAFT Final Report

John R. Niemann, Raymond B. Smith, William A. Norton, and Frederick S. Doten Mar. 1978 52 p refs
(AD-A068347; USAAEFA-77-11; USAAEFA-77-19) Avail: NTIS HC A04/MF A01 CSCL 01/3

The RU-21H (GR V) exhibited 1 deficiency and 10 shortcomings which will degrade its overall capability. The single-engine minimum-control airspeeds (V sub MC) were 5 to 10 knots greater than the data provided in the operator's manual. The incorrect V sub MC data presented in the operator's manual are a deficiency which warrants further testing and, as an interim measure, requires that a WARNING be incorporated in the operator's manual. Ten shortcomings listed in order of importance, are: (1) The dissimilar sense of operation of the attitude indicators; (2) the excessive glare in the cockpit caused by the navigation lights mounted on the upper surfaces of the external wing-tip pods; (3) the inaudibility of the stall warning horn when wearing helmet and oxygen mask; (4) the low intensity of the MASTER CAUTION and MASTER WARNING lights; (5) the inefficient arrangement of navigation and communications radios; (6) the premature activation of the artificial stall warning device; (7) the inability to shut down the engine by use of the condition lever; (8) the lightly damped, easily excited phugoid; (9) the ineffective lateral trim; and (10) the excessive force required to operate the radio/intercom switch. Within the scope of this test, the flying qualities of the RU-2H (GR V) aircraft are acceptable. GRA

N79-29179# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
A SIMULATION MODEL OF ATTACK HELICOPTER VULNERABILITY TO HOSTILE ARTILLERY FIRE M.S. Thesis
Emil H. Koenig, III Mar. 1979 82 p refs
(AD-A069753; AFIT/GST/SM/79M-4) Avail: NTIS HC A05/MF A01 CSCL 01/3

This thesis presents a methodology which simulates the activity, near the FEBA, of the Army's attack helicopter and the activity of hostile artillery in two formats: uniformly distributed area fire and precision fire against a point target as directed by a forward observer. A stochastic computer simulation was developed that varies the modeled activities from one replication to another. Current concepts of attack helicopter employment in the anti-armor role are used. Concepts of intervisibility, detectability, target location error, C-cubed time delay, and artillery round-to-round dispersion are also incorporated in the model. The model was experimented upon, using a hypothetical artillery weapon system, and the vulnerability predictions of the model are displayed and analyzed. GRA

06 AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography*.

N79-29180# Aeronautical Research Labs., Melbourne (Australia).
AN EXPERIMENTAL COMPARISON OF THE READABILITY OF TWO DIGITAL ALTIMETERS
G. R. White Dec. 1979 25 p refs
(ARL/SYS-Note-60; AR-001-325) Avail: NTIS HC A02/MF A01

Twelve male volunteer subjects with flying experience were required to read one of two digital altimeters while performing a two dimensional tracking task. It was found that the Smiths Type 3B servo altimeter was read in a significantly shorter time than was the Aero Mechanism Type 8047/20A capsule altimeter. The subjects evaluated indicate that the probability of misreading this altimeter is high. S.E.S.

N79-29181# TRW Defense and Space Systems Group, Redondo Beach, Calif.
DIGITAL AVIONICS INFORMATION SYSTEM (DAIS): DEVELOPMENT AND DEMONSTRATION Final Report, 28 Apr. 1975 - 30 Sep. 1978
R. C. Mason, T. R. Price, B. A. Rich, R. J. Slightam, J. A. Stautberg, W. P. Whalen, and C. E. Wilent Wright-Patterson AFB, Ohio AFAL Mar. 1979 169 p refs
(Contract F33615-75-C-1178; AF Proj. 2052)
(AD-A068438; AFAL-TR-79-1027) Avail: NTIS HC A08/MF A01 CSCL 09/3

The Digital Avionics Information System (DAIS) has been characterized as a system architecture which can be applied and configured for a broad class of avionic applications and missions. The DAIS concept, therefore, proposed that the processing, information transfer, and the control and display functions or core elements be common and service the avionic application functional areas on an integrated basis. These fundamental system characteristics, along with the DAIS system attributes, such as modifiability and modularity, are presented in this report. The specific system features which provide these characteristics and attributes are described. GRA

N79-29182# Dynamics Research Corp., Wilmington, Mass.
DIGITAL AVIONICS INFORMATION SYSTEM (DAIS): RELIABILITY AND MAINTAINABILITY MODEL USERS GUIDE, VOLUME 2 Final Report, May 1975 - Jul. 1977
Andrew J. Czuchry, Robert H. Kistler, John M. Glasier, and Marjorie A. Bristol Apr. 1979 139 p
(Contract F33615-75-C-5218; AF Proj. 2051)
(AD-A068826; AFHRL-TR-78-2(2)) Avail: NTIS HC A07/MF A01 CSCL 14/4

The digital avionics information system (DAIS) life cycle cost (LCC) study provides the Air Force with an enhanced inhouse capability to incorporate LCC considerations during all stages of the system acquisition process. This report documents a reliability and maintainability (R & M) model developed in the study and also serves as a users manual. The R & M model, a training model, and a cost model comprise the DAIS LCC impact model (LCCIM) designed for use in LCC analysis of avionics systems. In this context, its primary function is to manipulate input data banks to produce intermediate products, figures of merit, and outputs required by the training and cost models. When used in a stand-alone mode, the R & M model provides a means for analyzing the R M impact of changes in system design and maintenance concepts on system support requirements. GRA

N79-29183# Air Force Avionics Lab., Wright-Patterson AFB, Ohio. System Avionics Div.
DISPLAY MEASUREMENTS. CAN MTF ANALYSIS BE USED ON MATRIX DISPLAYS? Final Technical Report, 1 Jan. 1977 - 30 Sep. 1978
Richard A. Spearnock Feb. 1979 29 p refs
(AD-A068604; AFAL-TR-79-1030) Avail: NTIS HC A03/MF A01 CSCL 05/8

The use of modulation transfer function on matrix displays is investigated in this report. An analytical estimate of the MTF of a hypothetical 1000 X 1000 element liquid crystal display is given. The report concludes that modulation transfer function (MTF) can be useful in the analysis of matrix displays. GRA

N79-29184# Air Force Avionics Lab., Wright-Patterson AFB, Ohio.
DISPLAY MEASUREMENTS. THE EFFECTS OF HUD (HEAD-UP DISPLAYS) GLOW ON VISUAL PERFORMANCE Final Technical Report, 1 Jan. 1977 - 30 Sep. 1978
Richard A. Spearnock Feb. 1979 17 p refs
(AD-A068603; AFAL-TR-79-1031) Avail: NTIS HC A02/MF A01 CSCL 05/8

This report examines residual glow in head-up displays. The contrast threshold work of Blackwell is used to estimate the detrimental effects of this glow on operator (pilot) performance. It is shown that even small amounts of glow can have serious detrimental effects on performance. The amount of detriment is a function of the level of glow, the operator's state of luminance adaptation, and the perceived contrast ratio between the target and the surround. The methods used in this report can be used to examine cases other than the ones presented in the report as required. GRA

N79-29185# Air Force Avionics Lab., Wright-Patterson AFB, Ohio.
DISPLAY MEASUREMENTS. MEASUREMENTS OF REFLECTANCE-TYPE DISPLAYS Final Technical Report, 1 Jan. 1977 - 30 Sep. 1978

Richard A. Spearnock Feb. 1979 29 p refs
(AD-A068602; AFAL-TR-79-1029) Avail: NTIS HC A03/MF A01 CSCL 05/8

This report applies the Equation of Spencer and Gray to specify the reflectance of reflective-type displays. This reflectance specification uses both a diffuse component function and a specular component function to completely describe any reflecting surface. The particular display chosen to illustrate the use of this method of specifying reflectance was the Hughes' Liquid Crystal Matrix Display. This display is a matrix display and produces an image by electrically controlling the reflectance of each individual cell. In the appendix, a simplified example using this method of reflectance specification to evaluate a liquid crystal display optical system is given. GRA

N79-29186# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

A METHOD FOR EVALUATING KC-135 AVIONICS CONFIGURATIONS M.S. Thesis

Joel R. Jerabek Mar. 1979 84 p refs
(AD-A069446; AFIT/GST/MA/79M-5) Avail: NTIS HC A05/MF A01 CSCL 01/3

The KC/C-135 Avionics Modernization Program is currently tasked with determining the feasibility of replacing the KC/C-135 navigator with cost effective avionics systems. The Avionics Evaluation Program (AEP) is a computer model that has been built to evaluate the mission impact caused by alternate avionics hardware configurations. Although the AEP was designed to model tactical aircraft missions, this thesis examines whether it could be applied to the strategic mission of the KC-135. Aircraft performance data, hardware reliability data, and abort logic criteria were input into the model. A baseline simulation was conducted using the current KC-135 configuration. Two additional configurations, single inertial navigation systems (INS) with a navigator and dual INS without a navigator, were selected and simulations conducted. These simulations were conducted with both peacetime and wartime mission scenarios. An analysis of the AEP output data revealed that the addition of a single INS produced a significant improvement in Navigational Accuracy and that by replacing the navigator with a second INS, navigational accuracy could be maintained without a change in the mission success rate. GRA

N79-29187# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

IMPLEMENTATION AND TESTING OF NUMERICAL ANALYSIS TECHNIQUES IN AVIONICS APPLICATIONS M.S. Thesis

Richard Arthur Adams Mar. 1979 155 p refs
(AD-A069299; AFIT/GCS/EE/79-1) Avail: NTIS HC A08/MF A01 CSCL 09/2

Errors due to finite wordlength are unavoidable when aircraft signal processing operations such as flight control, navigation, and fire control are implemented on a digital computer. To reduce these errors to tolerable levels, longer word-lengths can sometimes be employed. The effects of some of the errors, such as those due to arithmetic series truncation, machine roundoff, and quantization of system coefficients, can be lessened somewhat by appropriate numerical analysis techniques. An n-bit simulator which runs on Control Data Corporation (CDC) 6600/CYBER 74 computer systems was modified and then used to evaluate the accuracy of a flight navigation routine coded in FORTRAN. The routines were executed without the simulator to obtain results used for benchmarking. The n-bit simulator was employed to simulate the numerical characteristics of the AN/AYK-15A digital processor. Error plots were constructed which show the maximum errors occurring within small plotting intervals plotted against each individual input value. These plots were used to aid visually in analyzing the error characteristics of the avionics routine as it would be implemented on the AN/AYK-15A. A critical analysis of the error plots obtained showed that routines which are coded using single-precision floating-point arithmetic are prone to errors which exceed the error bounds specified for the routines. This occurs even though range reductions in the trigonometric function approximations are accomplished using extended precision. GRA

07 AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *44 Energy Production and Conversion.*

N79-29188* Vought Corp., Dallas, Tex.

RAMJET COST ESTIMATING HANDBOOK Technical Report, Apr. 1976 - Jun. 1977

H. T. Emmons, D. L. Norwood, J. E. Rasmusen, and H. E. Reynolds Laurel, Md. Chem. Propulsion Inform. Agency May 1978 306 p
(Contract F33615-76-C-2043; AF Proj. 3012)
(AD-A056991; AFAPL-TR-77-50-Vol-2) HC A14/MF A01 CSCL 21/5

Research conducted under Air Force Contract F33615-76-C-2043 to generate cost data and to establish a cost methodology that accurately predicts the production costs of ramjet engines is presented. The cost handbook contains a description of over one hundred and twenty-five different components which are defined as baseline components. The cost estimator selects from the handbook the appropriate components to fit his ramjet assembly, computes the cost from cost computation data sheets in the handbook, and totals all of the appropriate cost elements to arrive at the total engine cost. The methodology described in the cost handbook addresses many different ramjet types from simple podded arrangements of the liquid fuel ramjet to the more complex integral rocket/ramjet configurations including solid fuel ramjets and solid ducted rockets. It is applicable to a range of sizes from 6 in diameter to 18 in diameter and to production quantities up to 5000 engines. M.M.M.

N79-29189*# Teledyne CAE, Toledo, Ohio.

ADVANCED GENERAL AVIATION TURBINE ENGINE (GATE) STUDY Final Report

R. Smith and E. H. Benstein Jun. 1979 150 p refs
(Contract NAS3-20757)
(NASA-CR-159624; Teledyne-CAE-1600) Avail: NTIS HC A07/MF A01 CSCL 21E

The small engine technology requirements suitable for general aviation service in the 1987 to 1988 time frame were defined. The market analysis showed potential United States engines sales of 31,500 per year providing that the turbine engine sales price approaches current reciprocating engine prices. An optimum engine design was prepared for four categories of fixed wing aircraft and for rotary wing applications. A common core approach was derived from the optimum engines that maximizes engine commonality over the power spectrum with a projected price competitive with reciprocating piston engines. The advanced technology features reduced engine cost, approximately 50 percent compared with current technology. J.M.S.

N79-29190*# Notre Dame Univ., Ind. Dept. of Electrical Engineering.

ALTERNATIVES FOR JET ENGINE CONTROL Annual Report, 1 Mar. 1978 - 28 Feb. 1979

Michael K. Sain 28 Feb. 1979 212 p refs
(Grant NsG-3048)
(NASA-CR-158390) Avail: NTIS HC A10/MF A01 CSCL 21E

The research is classified in two categories: (1) the use of modern multivariable frequency domain methods for control of engine models in the neighborhood of a set-point, and (2) the use of nonlinear modelling and optimization techniques for control of engine models over a more extensive part of the flight envelope. Progress in the first category included the extension of CARDIAD (Complex Acceptability Region for Diagonal Dominance) methods developed with the help of the grant to the case of engine models with four inputs and four outputs. A suitable bounding procedure for the dominance function was determined. Progress in the second category had its principal focus on automatic nonlinear model generation. Simulations of models produced

satisfactory results where compared with the NASA DYNGEN digital engine deck. R.E.S.

N79-29191*# General Electric Co., Evendale, Ohio. Aircraft Engine Group.
NASA CF6 JET ENGINE DIAGNOSTICS PROGRAM: LONG-TERM CF6-6D LOW-PRESSURE TURBINE DETERIORATION
Jeffrey J. Smith Aug. 1979 116 p refs
(Contract NAS3-20631)
(NASA-CR-159618; R79AEG356) Avail: NTIS HC A06/MF A01 CSCL 21E

Back-to-back performance tests were run on seven airline low pressure turbine (LPT) modules and four new CF6-6D modules. Back-to-back test cell runs, in which an airline LPT module was directly compared to a new production module, were included. The resulting change, measured in fuel burn, equaled the level of LPT module deterioration. Three of the LPT modules were analytically inspected followed by a back-to-back test cell run to evaluate current refurbishment techniques. Author

N79-29192*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
CRITERIA FOR SELF-IGNITION OF SUPERSONIC HYDROGEN-AIR MIXTURES
Paul W. Huber, Charles J. Schexnayder, Jr., and Charles R. McClinton Aug. 1979 58 p refs
(NASA-TP-1457; L-12678) Avail: NTIS HC A04/MF A01 CSCL 21A

A correlation of available self ignition data for supersonic hydrogen-air mixtures in configurations representative of scramjet combustors was made. The correlation was examined in light of simplified ignition-limit models. The data and model included cases of injection from transverse fuel jets on walls, transverse jets behind swept and unswept steps, and transverse injection ahead of swept and unswept steps and strut bases. The results provide useful guidance for predicting self ignition in a variety of applications. The likely regions for self ignition in a combustor are given in order of merit. K.L.

N79-29193# Naval Air Test Center, Patuxent River, Md.
AIRCRAFT ENGINE DRIVEN ACCESSORY SHAFT COUPLING IMPROVEMENTS USING HIGH-STRENGTH NONMETALLIC ADAPTER/BUSHINGS Progress Report
Aleck Loker 20 Apr. 1979 47 p refs
(AD-A068637; NATC-TM-79-1-SY; PR-2) Avail: NTIS HC A03/MF A01 CSCL 21/5

Engine driven accessories, such as generators, starters, and pumps, are commonly connected to their respective power takeoff shafts by splined couplings. These shaft couplings, which allow rapid installation and removal of the accessory, are capable of high torque transmission and are considered to be self-centering. However, because of their rapid wear and failure rate, NAVAIRTESTCEN has engaged in a continuing spline coupling improvement program over the past 11 years. An outgrowth of this program has been the development of the new high-strength nonmetallic spline coupling adapter/bushing technology. Previous Technical Memoranda, TM 76-1 SY and TM 78-1 SY, condensed the results of these coupling improvement efforts into a description of two basic spline coupling designs (crowned circular toothed and flat toothed splines), explained their apparent success, and presented limited application and manufacturing information. This report presents a summary of the new coupling designs which have been evaluated or are planned for future tests. Previously unpublished test data and the latest applicable Military Standard Drawings are also contained therein. GRA

N79-29194*# Pennsylvania State Univ., University Park. Applied Research Lab.
INVESTIGATION OF THE UNSTEADY PRESSURE DISTRIBUTION ON THE BLADES OF AN AXIAL FLOW FAN M.S. Thesis
Gary Franke 21 Nov. 1978 145 p refs
(Grant NGR-39-009-275; Contract N00024-79-C-6043)
(NASA-CR-162121; AD-A069619; ARL/PSU-TM-78-300)
Avail: NTIS HC A07/MF A01 CSCL 20D

The results of a program to investigate the distribution of unsteady pressure on the blades of a stator blade row in an axial flow turbomachine which operated in the wakes of an upstream rotor are presented. These unsteady pressure distributions were measured using a blade instrumented with a series of miniature pressure transducers which was developed in this program. Several geometrical and flow parameters--rotor/stator spacing, stator solidity, and stator incidence angle--were varied to determine the influence of these parameters on the unsteady response of the stator. GRA

08 AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

N79-29195*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
DESCRIPTION OF THE VTOL APPROACH AND LANDING TECHNOLOGY (VALT) CH-47 RESEARCH SYSTEM
James R. Kelly, Frank R. Niessen, John F. Garren, Jr., and Terence S. Abbott Aug. 1979 57 p refs
(NASA-TP-1436; L-12781) Avail: NTIS HC A04/MF A01 CSCL 01C

The Langley Research Center modified a CH-47B helicopter to provide a general-purpose variable-stability capability for the VTOL approach and landing technology (VALT) program. The functional aspects and capabilities of the overall system are described. Automatic decelerating approach data are presented to illustrate the performance of the overall system. A.R.H.

N79-29196*# Princeton Univ., N. J. Flight Research Lab.
AN IN-FLIGHT SIMULATOR INVESTIGATION OF ROLL AND YAW CONTROL POWER REQUIREMENTS FOR STOL APPROACH AND LANDING: DEVELOPMENT OF CAPABILITY AND PRELIMINARY RESULTS
D. R. Ellis and S. C. Raisinghani Apr. 1979 44 p refs
(Contract NAS2-7350)
(NASA-CR-152307; MAE-1422) Avail: NTIS HC A03/MF A01 CSCL 01C

A six-degree-of-freedom variable-response research aircraft was used to determine the minimum lateral-directional control power required for desirable and acceptable levels of handling qualities for the STOL landing approach task in a variety of simulated atmospheric disturbance conditions for a range of lateral-directional response characteristics. Topics covered include the in-flight simulator, crosswind simulation, turbulence simulation, test configrations, and evaluation procedures. Conclusions based on a limited sampling of simulated STOL transport configurations flown to touchdown out of 6 deg, 75 kt MLS approaches, usually with a sidestep maneuver are discussed. A.R.H.

09 RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tube facilities; and engine test blocks.

For related information see also *14 Ground Support Systems and Facilities (Space).*

N79-29197# Science Applications, Inc., La Jolla, Calif.
DEVELOPMENT OF CRITERIA FOR MONITORING OF AIRPORT GROUND POLLUTION. VOLUME 1: STUDY Final Report, Sep. 1975 - Jul. 1977
Claus B. Ludwig and J. Richard Yoder Nov. 1978 439 p refs 2 Vol.
(Contract DOT-FA76WA-3725)
(AD-A067242; SAI-77-910-LJ-Vol-1; FAA-RD-77-178-1-Vol-1)
Avail: NTIS HC A19/MF A01 CSCL 01/5

Criteria are developed by which the validity of pollution predictions and measurements in the airport environs can be judged. The criteria are applied to three technologies: (1) predictive

mathematical models; (2) measurements by point samplers; and (3) measurements by remote monitors. For mathematical models, the criterion is the agreement between predicted and measured pollution levels. Various mathematical models are described, analyzed and ranked by weighted attributes as screening models and as validation models. For point samplers, the criteria have been developed based on EPA-approved measurement principles and procedures for testing performance characteristics and for determining a consistent relationship to reference methods. Remote monitors belong to an evolving technology that has not yet been approved as to measurement principles. Thus, criteria are developed to select certain remote sensing systems as potential candidates for air enforcement monitors. Data validation procedures are developed for the selected remote monitors. Author

N79-29198# Science Applications, Inc., La Jolla, Calif.
DEVELOPMENT OF CRITERIA FOR MONITORING OF AIRPORT GROUND POLLUTION. VOLUME 2: DATA VALIDATION PROCEDURES Final Report, Sep. 1975 - Jul. 1977
Claus B. Ludwig and J. Richard Yoder Nov. 1978 435 p refs 2 Vol.
(Contract DOT-FA76WA-3725)
(AD-A067243; SAI-77-910-LJ; FAA-RD-77-178-2) Avail: NTIS HC A19/MF A01 CSCL 01/5

Criteria are presented which will allow the FAA to methodically interrogate remotely monitored data taken for R&D and future air enforcement purposes. While interrogation in the case of air enforcement appears more straightforward than for R&D, it is more demanding because of the requirement for demonstrating equivalency. Appendixes include: (1) National Primary and Secondary Ambient Air Quality Standards (40 CFR 50); (2) Ambient Air Monitoring Reference and Equivalent Methods (40 CFR 53); (3) guidelines for public reporting of daily air quality; (4) control of air pollution from aircraft and aircraft noise; (5) review of calibration span gases; (6) list of commercially available point source samplers; (7) derivation of signal-to-noise ratio equations and error analysis; (8) meteorological instruments for use in the calibration test range; and (9) electromagnetic interference characteristics requirements for equipment. A.R.H.

N79-29199*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
A UNIQUE FACILITY FOR V/STOL AIRCRAFT HOVER TESTING
Richard G. Culpepper, Ronald D. Murphy (Naval Air Systems Command, Washington, D. C.), Edward A. Gillespie (Rockwell Intern. Corp., Columbus, Ohio), and Archie G. Lane Aug. 1979 56 p ref
(NASA-TP-1473; L-12914) Avail: NTIS HC A04/MF A01 CSCL 14B

The Langley Impact Dynamics Research Facility (IDRF) was modified to obtain static force and moment data and to allow assessment of aircraft handling qualities during dynamic tethered hover flight. Test probe procedures were also established. Static lift and control measurements obtained are presented along with results of limited dynamic tethered hover flight. J.M.S.

N79-29200# Harco Corp., Medina, Ohio.
TECHNIQUES FOR CATHODIC PROTECTION TESTING OVER AIRFIELD PAVEMENTS Final Report, Aug. 1977 - Jul. 1978
Bernard Husock Tyndall AFB, Fla. Civil and Environ. Eng. Develop. Office Apr. 1979 71 p refs
(Contract F08635-77-C-0248; AF Proj. 2104)
(AD-A069045; CEEDO-TR-78-31) Avail: NTIS HC A04/MF A01 CSCL 13/11

This report summarizes the techniques developed for cathodic protection testing over airfield pavements. Test results conclusively proved that the accuracy of all pipe-to-surface potential measurements taken over pavement surfaces are questionable. On concrete pavement it was found that potential readings differed from readings on adjacent soil by more than 100 millivolts. Potential readings over well sealed asphalt surfaces were not possible even when using high input impedance, electronic voltmeters. Potential readings over deteriorated asphalt were possible but the accuracy was poor. Accurate potential measurements over pavement surfaces can be made only if the reference electrode contacts the surface beneath the pavement. This report recommends a procedure for easily penetrating the pavement surface and installing a pavement insert through which a modified reference electrode may be inserted. GRA

12 ASTRONAUTICS (GENERAL)

For extraterrestrial exploration see *91 Lunar and Planetary Exploration.*

N79-29201* National Aeronautics and Space Administration, Washington, D. C.
TECHNOLOGY FOR LARGE SPACE SYSTEMS: A SPECIAL BIBLIOGRAPHY WITH INDEXES, SUPPLEMENT 1
Jul. 1979 76 p refs
(NASA-SP-7046(01)) Avail: NTIS HC A05 CSCL 22A

This bibliography lists 180 reports, articles, and other documents introduced into the NASA scientific and technical information system between January 1, 1979 and June 30, 1979. Its purpose is to provide helpful information to the researcher, manager, and designer in technology development and mission design in the area of the Large Space Systems Technology (LSST) Program. Subject matter is grouped according to systems, interactive analysis and design, structural concepts, control systems, electronics, advanced materials, assembly concepts, propulsion, and flight experiments. Author

N79-29202* National Aeronautics and Space Administration, Washington, D. C.
NASA SELECTS 40 INVESTIGATIONS FOR SPACELAB/SHUTTLE FLIGHTS
30 Aug. 1979 7 p
(NASA-News-Release-79-112; P79-10112) Avail: NASA Scientific and Technical Information Facility, P.O. Box 8757, B.W.I. Airport, Md. 21240 CSCL 22A

Seven experiments proposed by scientists in Belgium, Canada, France, and Japan were chosen, along with 33 investigations from the United States, to be studied and developed for a series of shuttle flights planned for the period between 1983 and 1985. The cost of the U.S. effort is expected to total about $100 million over the next five-year period. The foreign countries will fund their own investigations. The disciplines involved are astronomy, upper atmospheric physics, solar physics, and high energy astrophysics. A list of the investigators, the organizations they represent, and the names of the experiments is included. A.R.H.

N79-29203*# General Dynamics/Convair, San Diego, Calif.
SPACE CONSTRUCTION AUTOMATED FABRICATION EXPERIMENT DEFINITION STUDY (SCAFEDS), PART 3. VOLUME 2: STUDY RESULTS Final Report
29 Jun. 1979 309 p refs
(Contract NAS9-15310)
(NASA-CR-160288; CASD-ASP78-016-Vol-2) Avail: NTIS HC A14/MF A01 CSCL 22A

The detailed results of all part 3 study tasks are presented. Selected analysis was performed on the beam builder conceptual design. The functions of the beam builder and a ground test beam builder were defined. Jig and fixture concepts were developed and the developmental plans of the beam builder were expounded. R.E.S.

N79-29204*# Lunar and Planetary Inst., Houston, Tex.
EXTRATERRESTRIAL MATERIALS PROCESSING AND CONSTRUCTION Final Report
David R. Criswell 30 Sep. 1978 476 p refs
(Contract NSR-09-051-001)
(NASA-CR-158870; Rept-713-488-5200) Avail: NTIS HC A21/MF A01 CSCL 22A

Applications of available terrestrial skills to the gathering of lunar materials and the processing of raw lunar materials into industrial feed stock were investigated. The literature on lunar soils and rocks was reviewed and the chemical processes by which major oxides and chemical elements can be extracted were identified. The gathering of lunar soil by means of excavation equipment was studied in terms of terrestrial experience with

strip mining operations on earth. The application of electrostatic beneficiation techniques was examined for use on the moon to minimize the quantity of materials requiring surface transport and to optimize the stream of raw materials to be transported off the moon for subsequent industrial use. R.E.S.

N79-29205# Technische Physische Dienst TNO-TH, Delft (Netherlands).
ANALYSIS AND UPDATING OF SPACELAB USER REQUIREMENTS. VOLUME 1: REVIEW OF USER DISCIPLINES
A. Hammerschlag, H. A. T. Timmers, F. J. Abbink, and N. J. J. Bunnik (NLR) Paris ESA Sep. 1978 179 p refs 2 Vol.
(Contract ESTEC-3432/77)
(TPD-711.285-Vol-1; ESA-CR(P)-1150-Vol-1) Avail: NTIS HC A09/MF A01

European user requirements for Spacelab were studied based on input documentation provided by the European Space Agency (ESA). The study was restricted to use of Spacelab in its present concept as a space-research facility to be flown in the cargo bay of the orbiter of the Space Transportation System. User disciplines are defined in their own terms of reference. The aims of the users are reflected in a set of model payload experiments which are considered to be representative for the future use of Spacelab. Author (ESA)

N79-29206# Technische Physische Dienst TNO-TH, Delft (Netherlands).
ANALYSIS AND UPDATING OF SPACELAB USER REQUIREMENTS: VOLUME 2: REVIEW OF SPACELAB SYSTEMS FROM USER POINT OF VIEW
A. Hammerschlag, H. A. T. Timmers, F. J. Abbink, and N. J. J. Bunnik (NLR) Paris ESA Oct. 1978 239 p refs 2 Vol.
(Contract ESTEC-3432/77)
(TPD-711.285-Vol-2; ESA-CR(P)-1150-Vol-2) Avail: NTIS HC A11/MF A01

Abridged accomodation exercises on payloads compared from the model payload experiments previously defined were performed. Mission characteristics such as orbit and attitude timeline as well as the design of Spacelab and the experiments were examined. Three types of missions were identified, denoted respectively as sky-, earth-, and 0-G mission. Ease of integration as an important aspect of experimental accomodation is emphasized. Clear and simple interfaces and the possibility of developing experiments and other parts of a payload autonomously up to high level of confidence are considered in relation to payload overall organization. Author (ESA)

13 ASTRODYNAMICS

Includes powered and free-flight trajectories; and orbit and launching dynamics.

N79-29207 Michigan Univ., Ann Arbor.
OPTIMAL REENTRY TRAJECTORIES OF A LIFTING VEHICLE Ph.D. Thesis
Jeng-Shing Chern 1979 120 p
Avail: Univ. Microfilms Order No. 7916680

The success of future permanent space stations depends on the development of a space shuttle vehicle having aerodynamic maneuvering capability. The optimum maneuver of such a vehicle reentering a spherical, stationary, and locally exponential planetary atmosphere is investigated. A set of dimensionless variables called the modified Chapman's variables and a rescaled lift-drag polar to derive the dimensionless equations of motion for flight analysis are introduced. For planar flight, two main types of optimum maneuver, the pull-up type and the gliding type, are investigated at three different altitudes, low, moderate, and very high. For three-dimensional flight, the procedure to solve the optimum trajectory for maximum cross range is discussed. Dissert. Abstr.

N79-29208# Naval Research Lab., Washington, D. C. Communication Sciences Div.
EQUATIONS OF POWERED ROCKET ASCENT AND ORBIT TRAJECTORY Final Report
M. H. Reilly 7 May 1979 33 p refs
(AD-A069296; NRL-8237) Avail: NTIS HC A03/MF A01 CSCL 22/3

Equations of rocket and satellite dynamics are obtained at various levels of approximation and make possible analyses of powered rocket ascent, orbit injection, and subsequent orbital motion. Rocket and satellite trajectory are specified by these equations, which include the effects of earth's rotation and curvature. Various analysis techniques are given, so that the investigator can choose the simplest one suited to his needs. In the process, material not readily available is presented, and some problems of ambiguity and inaccuracy in standard references are resolved. GRA

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

Includes launch complexes, research and production facilities; ground support equipment, mobile transporters; and simulators.

For related information see also *09 Research Support Facilities (Air)*.

N79-29209# Range Commanders Council, White Sands Missile Range, N. Mex. Range Safety Group.
RISK ANALYSIS TECHNIQUES
Mar. 1979 150 p refs
(AD-A068714; RSG-315-79) Avail: NTIS HC A07/MF A01 CSCL 13/12

The goal of Range Safety is to prevent injury of personnel or damage to property by taking all reasonable precautions consistent with operational requirements. Achievement of this goal begins early in the evaluation of a proposed test program, in fact, in many instances prior to the definition and design of the range safety system that will be used during real-time operation. To ascertain the degree of protection required, the system to be tested must be evaluated to determine the geographic boundaries and makeup of the test area. If the area contains no facilities or personnel, no precautions are necessary other than surveillance of the area to ensure that it remains clear during the test. But, if the test area is large and contains facilities and personnel, it is necessary to determine, either by qualitative or quanitative analysis, those hazards produced by the test. The results of this analysis will define the level of risk and, therefore, the restrictions that must be placed on the test program or the risk that must be accepted in order for the tests to be conducted. A survey of five of the test ranges represented in the Range Safety Group (RSG), Range Commanders Council (RCC), was made to determine the types of risk analyses conducted and the uses to which risk data are put in developing test restrictions. This information is presented in this document to provide all ranges with the various techniques employed which may have merit for their application. GRA

15 LAUNCH VEHICLES AND SPACE VEHICLES

Includes boosters; manned orbital laboratories; reusable vehicles; and space stations.

N79-29210* National Aeronautics and Space Administration, Washington, D. C.
PIONEER TO ENCOUNTER SATURN ON SEPTEMBER 1
22 Aug. 1979 80 p
(NASA-News-Release-79-108; P79-10110) Avail: NASA Scientific and Technical Information Facility, P.O. Box 8757, B.W.I. Airport, Md. 21240 CSCL 22A

The encounter of the Pioneer 11 Spacecraft with Saturn, designed to provide information on the evolution of the Sun and its planets, is described. Photographs and measurements of Saturn, its rings, and several of its 10 satellites, including Titan, to be taken by Pioneer instruments, are emphasized. The encounter sequence and spacecraft trajectory are discussed. A descrintion

of Saturn and its atmosphere is included. Onboard instruments and experiments are also described. J.M.S.

N79-29211*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ORBITING DEEP SPACE RELAY STATION STUDY. VOLUME 2: CONCEPTUAL DESIGN Final Report
John A. Hunter 15 Jun. 1979 128 p refs
(Contrac* NAS7-100)
(NASA-CR-158816; JPL-Pub-79-30-Vol-2) Avail: NTIS HC A07/MF A01 CSCL 22B

The Orbiting Deep Space Relay Station conceptual design is described. The baseline for implementation cost and schedule estimates is also described. R.E.S.

N79-29212# Committee on Science and Technology (U. S. House).
SOLAR POWER SATELLITE
Washington GPO 1979 344 p refs Hearings before the Subcomm. on Space Sci. and Applications of the Comm. on Sci. and Technol., 96th Congr., 1st Sess., 28-30 Mar. 1979
(GPO-45-997) Avail: Subcomm. on Space Sci. and Applications

A technology verification program to enable the resolution of the technical, environmental, and economic issues surrounding the concept of a solar power satellite is considered. Specific issues discussed include: biological and ionospheric impacts; radio frequency interference; and research on the space segment of the microwave power system to ensure technical and economic feasibility. J.M.S.

N79-29213*# Grumman Aerospace Corp., Bethpage, N.Y.
SPACE FABRICATION DEMONSTRATION SYSTEM, TECHNICAL VOLUME Final Report
15 Mar. 1979 117 p
(Contract NAS8-32472)
(NASA-CR-161286; NSS-SFDS-RP013) Avail: NTIS HC A06/MF A01 CSCL 22A

The automatic beam builder ABB was developed, fabricated, and demonstrated within the established contract cost and schedule constraints. The ABB demonstrated the feasibility of: producing lightweight beams automatically within the required rate of 1 to 5 ft of completed beam per minute and producing structurally sound beams with axial design load of 5538 N based on the Grumman photovoltaic satellite solar power system design reference structure. Author

N79-29214*# Grumman Aerospace Corp., Bethpage, N.Y.
SPACE FABRICATION DEMONSTRATION SYSTEM: EXECUTIVE SUMMARY Final Report
15 Mar. 1979 35 p
(Contract NAS8-32472)
(NASA-CR-161287; NSS-SFDS-RP013) Avail: NTIS HC A03/MF A01 CSCL 22A

The results of analysis and tests conducted to define the basic 1-m beam configuration required, and the design, development, fabrication, and verification tests of the machine required to automatically produce these beams are presented. M.M.M.

N79-29215*# Bendix Corp., Teterboro, N. J. Guidance Systems Div.
SPACE CONSTRUCTION BASE CONTROL SYSTEM Final Report
27 Oct. 1978 362 p refs
(Contract NAS8-32660)
(NASA-CR-161288) Avail: NTIS HC A16/MF A01

Aspects of an attitude control system were studied and developed for a large space base that is structurally flexible and whose mass properties change rather dramatically during its orbital lifetime. Topics of discussion include the following: (1) space base orbital pointing and maneuvering; (2) angular momentum sizing of actuators; (3) momentum desaturation selection and sizing; (4) multilevel control technique applied to configuration one; (5) one-dimensional model simulation; (6) N-body discrete coordinate simulation; (7) structural analysis math model formulation; and (8) discussion of control problems and control methods. Author

N79-29216*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
HEAO-C OBSERVATORY DESCRIPTION
Carroll Dailey and Thomas A. Parnell Aug. 1979 22 p
(NASA-TM-78236) Avail: NTIS HC A02/MF A01 CSCL 22B

The spacecraft subsystems, scientific instrumentation, and the mission operations concept of the HEAO-C program are presented as an aid to HEAO guest observers. Scientific participants such as Principal Investigators and Co-investigators are presented. M.M.M.

N79-29217# Pritsker and Associates, Inc., West Lafayette, Ind.
A SAINT MODEL FOR THE AN/TSQ-73 MISSILE MINDER. USER'S GUIDE Final Report, Dec. 1977 - Aug. 1978
David B. Wortman and Alonzo F. Hixson, III Aug. 1978 201 p refs
(Contract DAHC19-77-M-0031; DA Proj. 2Q7-62722-A-765) (AD-A068998; ARI-RN-79-6) Avail: NTIS HC A10/MF A01 CSCL 17/2

SAINT, Systems Analysis of Integrated Networks of Tasks, is a network modeling and simulation technique developed to assist in the design and analysis of complex, man-machine systems. SAINT provides the concepts necessary to model systems that consist of tasks (discrete elements), state variables (continuous elements), and interactions between them. It facilitates the assessment of the contribution that system components make to overall system performance. GRA

N79-29218# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
AUTOMATED PROCESSING OF SATELLITE IMAGERY DATA: TEST OF A SPECTRAL CLASSIFIER Final Report, 11 Apr. 1977 - 31 Jan. 1979
Ronald M. Pickett and Elliott S. Blackman Hanscom AFB, Mass. AFGL Mar. 1979 44 p refs
(Contract F19628-77-C-0164; AF Proj. 6670)
(AD-A068663; BBN-4053; AFGL-TR-79-0040) Avail: NTIS HC A03/MF A01 CSCL 05/8

This report details the development and testing of algorithms for automated classification of Very High Resolution (VHR) cloud imagery from orbiting weather satellites. The imagery data are first processed into average wave number spectra. The spectral features are then input to a Bayesian quadratic discriminant classifier. The classifier is designed to work with VHR visual and IR data, but was tested here on VHR visual data alone. Comparison of the classifier to a blind processor using a priori probabilities shows accuracy of classification appreciably better than chance. GRA

N79-29219# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
INFERENCE OF PROBABILITY OF KILL OF AIR-TO-AIR MISSILE IN VARIOUS ATTACK MODES M.S. Thesis
Carl J. Vogel Mar. 1979 103 p
(AD-A069382; AFIT/GST/SM/79M-7) Avail: NTIS HC A06/MF A01 CSCL 16/4

This research was conducted with the objective of estimating discrete probabilities of successful employment of tactical air-to-air guided missiles in three modes of operation and to estimate confidence intervals about these probabilities of success which did not exceed .20 in length at the 80% level of confidence. A set of proxy data consisting of 34 missile launches was randomly generated to simulate the results of a test series. This set of proxy data was analyzed using Regression Analysis techniques, mathematical modeling of the results of the test series as probability density functions, and Bayesian techniques. Regression analysis techniques did not provide usable results in this application, but the failure may have been due to the nature of the data being analyzed. The events in the flight of a missile were modeled as Beta probability density functions which were statistically combined and inferences were drawn from the distribution representing the overall probability of success. To demonstrate the use of Bayesian techniques to determine a prior distribution from historical data, the basic data was assumed to have been replicated and was then reanalyzed. These analyses did not meet the stated objectives because the means could not be statistically separated at the 80% level of confidence. The lengths of the associated 80% confidence intervals exceeded

the objective of less than or equal to .20 in length for all cases when the basic proxy data was analyzed and in one of the three cases when historical data was assumed. Depending on the availability of historical data and the suitability of the approach, a combination of mathematical modeling and Bayesian techniques may meet the stated objectives. GRA

16 SPACE TRANSPORTATION

Includes passenger and cargo space transportation e.g., shuttle operations; and rescue techniques.

For related information see also *03 Air Transportation and Safety* and *85 Urban Technology and Transportation.*

N79-29220*# Northrop Services, Inc., Huntsville, Ala. Engineering and Technology Center.
SPACE SHUTTLE PLUME/SIMULATION APPLICATION: RESULTS AND MATH MODEL SUPERSONIC DATA Final Report
W. Boyle, B. Conine, and G. Bell 15 May 1979 138 p refs (Contract NAS8-32524)
(NASA-CR-161274; TR-230-1963) Avail: NTIS HC A07/MF A01 CSCL 21H

The analysis of pressure and gage wind tunnel data from space shuttle wind tunnel test IA138 was performed to define the aerodynamic influence of the main propulsion system and solid rocket booster plumes on the total vehicles, elements, and components of the space shuttle vehicle during the supersonic portion of ascent flight. A math model of the plume induced aerodynamic characteristics was developed for a range of Mach numbers to match the forebody aerodynamic math model. The base aerodynamic characteristics are presented in terms of forces and moments versus attitude. Total vehicle base and forebody aerodynamic characteristics are presented in terms of aerodynamic coefficients for Mach numbers from 1.55 to 2.5. M.M.M.

N79-29221*# Northrop Services, Inc., Huntsville, Ala. Engineering and Technology Center.
SPACE SHUTTLE PLUME/SIMULATION APPLICATION Final Summary Report
W. Boyle, B. Conine, and G. Bell 15 May 1979 75 p refs (Contract NAS8-32524)
(NASA-CR-161275; TR-230-1964) Avail: NTIS HC A04/MF A01 CSCL 20H

An analysis of pressure and strain-gage data from space shuttle wind tunnel test IA119 and IA138 was performed to define the influence on aerodynamic characteristics resulting from the main propulsion system and solid rocket booster plumes. Aerodynamic characteristics of each of the elements, the components and total vehicle of the space shuttle vehicle during ascent flight was considered. Pressure data were obtained over the aft portions of the space shuttle wind tunnel model in addition to wing and elevon gage data. M.M.M.

17 SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING

Includes telemetry; space communications networks; astronavigation; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications.*

No abstracts in this category.

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes spacecraft thermal and environmental control; and attitude control.

For life support systems see *54 Man/System Technology and Life Support.* For related information see also *05 Aircraft Design, Testing and Performance* and *39 Structural Mechanics.*

N79-29222 Howard Univ., Washington, D. C.
THE DYNAMICS AND OPTIMAL CONTROL OF SPINNING SPACECRAFT WITH MOVABLE TELESCOPING APPENDAGES Ph.D. Thesis
Ramasamy Gounder Sellappan 1977 178 p
Avail: Univ. Microfilms Order No. 7915942

Two types of telescoping appendages were considered: (1) where the end masses are mounted at the end of the assumed massless booms; and (2) where the appendages are assumed to consist of a uniformly distributed homogeneous mass throughout their lengths. For the telescoping system, Eulerian equations of motion were developed. Closed-form analytical solutions for the time response of the transverse components of angular velocity were obtained for the spacecraft hub with spherical and nearly spherical mass distribution. As an application to spacecraft rescue and recovery, booms were extended along all the principal axes to (1) detumble a symmetrical spacecraft, and (2) achieve a desired final spin about one of the principal axes. Dissert. Abstr.

N79-29223*# National Aeronautics and Space Administration, Washington, D. C.
EVALUATION OF THE EFFECT OF ELASTIC JOINTS ON THE AUTO-OSCILLATION OF SPACECRAFT WITH GAS-REACTIVE DIRECTION SYSTEMS
G. G. Sasin Jul. 1979 54 p refs Transl. into ENGLISH of "Otsenka Vliyaniya Uprugosti Prisoedinennykh Elementov Konstruktsii na Avtokolebaniya Kosmicheskogo Letatelnogo Apparata s Gasoreaktivnoi Sistemoi Upravleniya", Rept. Pr-407 Acad. of Sci. USSR, Inst. of Space Res., Moscow, 1978 p 1-52 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-75648; Pr-407) Avail: NTIS HC A04/MF A01 CSCL 22B

A mathematical model was obtained, on the basis of the method of mixed coordinates, of a generalized flexible spacecraft at one end of which was appended the directive action of a system of gas reactive nozzles. Various structural forms were obtained functionally describing flexible spacecraft, as systems consisting of a solid central body with flexible structural elements joined to it. A.W.H.

N79-29224*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COMPUTER AND LABORATORY SIMULATION OF INTERACTIONS BETWEEN SPACECRAFT SURFACES AND CHARGED-PARTICLE ENVIRONMENTS
N. John Stevens 1979 39 p refs Presented at 12th Fluid and Plasma Dyn. Conf., Williamsburg, Va., 24-26 Jul. 1979; sponsored by AIAA
(NASA-TM-79219; E-111) Avail: NTIS HC A03/MF A01 CSCL 22B

Cases where the charged-particle environment acts on the spacecraft (e.g., spacecraft charging phenomena) and cases where a system on the spacecraft causes the interaction (e.g., high voltage space power systems) are considered. Both categories were studied in ground simulation facilities to understand the processes involved and to measure the pertinent parameters. Computer simulations are based on the NASA Charging Analyzer Program (NASCAP) code. Analytical models are developed in this code and verified against the experimental data. Extrapolation from the small test samples to space conditions are made with this code. Typical results from laboratory and computer simulations are presented for both types of interactions. Extrapolations from these simulations to performance in space environments are discussed. A.R.H.

N79-29225# California Univ., San Diego. Dept. of Physics.
[LOW ENERGY PARTICLE DETECTOR] Final Report, 1 Apr. - 30 Sep. 1977
Elden C. Whipple and Sherman DeForest 29 Jun. 1978 5 p
(Contract N00014-77-MP-0018)
(AD-A068756) Avail: NTIS HC A02/MF A01 CSCL 18/4

The work performed during the period of this contract consisted primarily of fabrication and assembly of the flight unit; assembly and testing of the engineering unit (to be used for preliminary checkout on the spacecraft and as a spare); assembly of the ground support equipment (GSE); and preparation of test plans and computer software. GRA

19 SPACECRAFT INSTRUMENTATION

For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography*.

No abstracts in this category.

20 SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components e.g., rocket engines; and spacecraft auxiliary power sources.

For related information see also *07 Aircraft Propulsion, 28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

N79-29226*# Aerotherm Acurex Corp., Mountain View, Calif.
SUBSCALE SOLID MOTOR NOZZLE TESTS, PHASE 4 AND NOZZLE MATERIALS SCREENING AND THERMAL CHARACTERIZATION, PHASE 5 Final Report, Feb. 1976 - Mar. 1979
J. Arnold, J. Dodson, and B. Laub Jun. 1979 219 p refs
(Contract NAS8-30264)
(NASA-CR-161254; TM-79-255) Avail: NTIS HC A10/MF A01 CSCL 21H

Subscale solid motor nozzles containing a baseline material or low cost materials to be considered as potential replacements for the baseline material are designed and tested. Data are presented from tests of four identically designed 2.5 inch throat diameter nozzles and one 7 inch throat diameter nozzle. The screening of new candidate low cost materials, as well as their thermophysical and thermochemical characterization is also discussed. K.L.

N79-29227*# Tennessee Technological Univ., Cookeville. Coll. of Engineering.
STABILITY ANALYSIS OF A LIQUID FUEL ANNULAR COMBUSTION CHAMBER M.S. Thesis
Gary H. McDonald Aug. 1979 154 p refs
(Grant NGR-43-003-015)
(NASA-CR-158885) Avail: NTIS HC A08/MF A01 CSCL 21H

The problems of combustion instability in an annular combustion chamber are investigated. A modified Galerkin method was used to produce a set of modal amplitude equations from the general nonlinear partial differential acoustic wave equation. From these modal amplitude equations, the two variable perturbation method was used to develop a set of approximate equations of a given order of magnitude. These equations were modeled to show the effects of velocity sensitive combustion instabilities by evaluating the effects of certain parameters in the given set of equations. By evaluating these effects, parameters which cause instabilities to occur in the combustion chamber can be ascertained. It is assumed that in the annular combustion chamber, the liquid propellants are injected uniformly across the injector face, the combustion processes are distributed throughout the combustion chamber, and that no time delay occurs in the combustion processes. A.W.H.

N79-29228*# Tennessee Technological Univ., Cookeville. Coll. of Engineering.
ANALYSIS OF COMBUSTION INSTABILITY IN LIQUID FUEL ROCKET MOTORS Ph.D. Thesis
Kin-Wing Wong Aug. 1979 123 p refs
(Grant NGR-43-003-015)
(NASA-CR-158884) Avail: NTIS HC A06/MF A01 CSCL 21H

The development of an analytical technique used in the solution of nonlinear velocity-sensitive combustion instability problems is presented. The Galerkin method was used and proved successful. The pressure wave forms exhibit a strong second harmonic distortion and a variety of behaviors are possible depending on the nature of the combustion process and the parametric values involved. A one dimensional model provides insight into the problem by allowing a comparison of Galerkin solutions with more exact finite difference computations. M.M.M.

N79-29229# Aerospace Corp., El Segundo, Calif. Chemistry and Physics Lab.
INVERSION OF PLUME RADIANCE AND ABSORPTANCE DATA FOR TEMPERATURE AND CONCENTRATION Final Report
Stephen J. Young Sep. 1978 234 p refs
(Contract F04701-77-C-0078)
(AD-A068437; SAMSO-TR-79-30; AFRPL-TR-78-60) Avail: NTIS HC A11/MF A01 CSCL 21/2

The usefulness of the inversion of rocket plume infrared emission and absorption profiles obtained experimentally in transverse scans across the nozzle exit plane in order to retrieve radial profiles of plume temperature and concentration is examined in detail. Principal aspects on the problem included: (1) the use of state-of-the-art band radiation models that account for highly nonuniform plumes and Doppler broadening effects; (2) the development of an iterative Abel inversion algorithm that allows the application of the well-known Abel inversion to nonthin optical sources; and (3) the formulation of a 'quasi-objective' data smoothing procedure. The characteristics and error of inversion are determined for several synthetic data cases which approximate real rocket plumes and applied to actual data obtained from engine test firings. GRA

N79-29230# Aeronautical Research Associates of Princeton, Inc., N. J.
EVALUATION OF TURBULENCE MODELS FOR ROCKET AND AIRCRAFT PLUME FLOWFIELD PREDICTIONS, VOLUME 1 Final Report
H. S. Pergament, S. M. Dash, and A. K. Varma Feb. 1979 48 p refs
(Contract N00123-78-C-0010; ZF32392002)
(AD-A068388; ARAP-370-Vol-1) Avail: NTIS HC A03/MF A01 CSCL 20/4

A systematic evaluation of several turbulence models for use in aircraft and rocket plume flowfield predictions is presented. Eddy viscosity and two equation (TKE) models presently utilized for plume calculations have been incorporated into a mixing/afterburning code (BOAT) and tested against a wide range of laboratory data. These data include incompressible and compressible free shear layers and jets, H2/air subsonic and subsonic reacting flows and a liquid propellant rocket plume. The significant differences between rocket/aircraft plume flowfields and the laboratory test conditions used to determine the turbulence model 'constants' are discussed. The two-equation (K 2) model, with a suitable correction for compressibility, adequately predicts all the nonreacting shear layer and jet cases and the subsonic H2/air reacting jet case, but does not fare as well in the supersonic H2/air reacting jet and liquid propellant plume cases. Suggestions are given for K 2 model improvements to account for the noted inadequacies in compressible, reacting flows, and a recommended method for implementing these model improvements is provided. GRA

N79-29231# Army Missile Research and Development Command, Redstone Arsenal, Ala. Technology Lab.
STATIC FIRING TESTS FOR EVALUATION OF PLUME

EFFECTS ON MISSILE RF SUSCEPTIBILITY
Lee Johnson 11 Oct. 1978 59 p refs
(AD-A069128; DRDMI-T-79-10) Avail: NTIS HC A04/MF A01 CSCL 20/14

Theoretical analysis of the electrical properties of the REDEYE missile exhaust plume attributes a maximum conductivity to the plume of a few tenths of a mho/m in a region close to the motor nozzle. The conductivity decreases along the length of the plume and exhibits a radical dependence. When a REDEYE missile is exposed to an RF field, the presence of the current on the plume can be expected to affect the distribution of the current on the missile skin and to thus affect the RF energy coupled into the interior through apertures such as the seeker dome. A plume Effects Test Program was conducted in May 1977 to evaluate the effect of the missile plume on the coupling of electromagnetic energy into the interior of the REDEYE missile. The tests were conducted with the missile in a strap-down configuration at the White Sands Missile Range Electromagnetic Radiation Effects Site. GRA

N79-29232# Science Applications, Inc., Berkeley, Calif.
SYNTHESIS OF A PLUME SIMULATOR FOR THE MX MISSILE Topical Report, 7 Nov. 1977 - 31 May 1978
John Lam 31 May 1978 38 p ref Prepared by Dikewood Ind., Inc., Los Angeles
(Contract DNA001-77-C-0184)
(AD-A068623; AD-E300507; DNA-4615T) Avail: NTIS HC A03/MF A01 CSCL 20/14

A simulator for the exhaust plume of an MX missile is synthesized for use in the in-flight EMP hardness assessment of the missile in an EMP simulator. The synthesis is based on a set of results obtained in a numerical analysis of the interaction between the missile plume and an EMP which uses the Titan-III missile plume data scaled to the MX missile dimensions. It is found that, for this case, the plume simulator can be made entirely out of passive lumped LRC elements. GRA

23 CHEMISTRY AND MATERIALS (GENERAL)

Includes biochemistry and organic chemistry.

N79-29233 British Library Lending Div., Boston Spa (England).
DETERMINATION OF HYDROXYL GROUPS IN EPOXY AND POLYOXYPHENYLENE RESINS BY GASOMETRIC METHOD
Feliksa Majewska and Zdzislawa Glinka Nov. 1978 10 p refs Transl. into ENGLISH from Polimery (Warsaw), v. 19, no. 12, 1974 p 622-624
(BLL-RAE-Trans-1990-(5207); RAE-Lib-Trans-1990; BR67086) Avail: British Library Lending Div., Boston Spa, Engl.

The experimental details for the determination of hydroxyl groups in epoxy and polyoxyphenylene resins are presented. The method is based on the quantitative reaction of hydroxyl groups with lithium aluminum hydride, and the measurement of the hydrogen released. This avoids the difficulty of the epoxy groups reacting with the reagent employed. A.W.H.

N79-29234 Delaware Univ., Newark.
CATALYST DEACTIVATION IN THE HYDROPROCESSING OF COAL-DERIVED LIQUIDS Ph.D. Thesis
Minshon Jebb Chiou 1979 229 p
Avail: Univ. Microfilms Order No. 7918801

Aged catalysts used in H-coal liquefaction process were analyzed with a scanning electron microscope and an electron microscope. The results show that the deposition of coal mineral matter is a general phenomenon in the hydroprocessing of coal slurries. Kinetic simulations were developed to investigate the effect of coke laydown causing pore blockage and the effect of partially closed pores on hindered diffusion of larger molecules. The results show that sometimes improvements in catalyst life and activity level can be obtained by proper selection of the pore size. The moment analysis method was extended for microreactors by representing the internal diffusion processes in the catalyst as a solid film resistance. This approximation simplifies the experimental analysis for complex reaction system.
Dissert. Abstr.

N79-29235# Illinois Univ. at Urbana-Champaign. Dept. of Chemistry.
CHEMILUMINESCENCE OF ORGANIC PEROXIDES: THE CONVERSION OF GROUND STATE REACTANTS TO EXCITED STATE PRODUCTS BY THE CHEMICALLY INITIATED ELECTRON-EXCHANGE LUMINESCENCE
Gary B. Schuster Apr. 1979 39 p refs
(Contract N00014-76-C-0745)
(AD-A068434; TR-19) Avail: NTIS HC A03/MF A01 CSCL 07/3

A mechanism for thermal production of excited states is discussed. Electron transfer from an easily oxidized donor to a suitable organic peroxide followed by oxygen-oxygen bond cleavage generates radical ion intermediates. Subsequent chemical reaction followed by charge annihilation generates electronically excitated state products. This sequence of reactions is called chemically initiated electron-exchange luminescence and is shown to be operating for diphenoyl peroxide, 1-phenylethylperoxy acetate, dimethyldioxeta-none, and 1,4-diphenyl-2,3-benzodioxin (O-xylylene peroxide). GRA

N79-29236# Little (Arthur D.), Inc., Cambridge, Mass.
EPA/IERL-RTP PROCEDURES FOR LEVEL 2 SAMPLING AND ANALYSIS OF ORGANIC MATERIALS Final Task Report, Jun. - Dec. 1977
J. C. Harris, M. J. Hayes, P. L. Levins, and D. B. Lindsay Feb. 1979 164 p refs
(Contract EPA-68-02-2150)
(PB-293800/9; EPA-600/7-79-033) Avail: NTIS HC A08/MF A01 CSCL 07D

Procedures for sampling and chemical analysis of organic materials provide a methodology for chemical and biological assessment of environment effects of industrial effluents. Concepts and general guidelines, together with a number of more fully developed, tested, and validated procedures were presented. Users of the manual can find a number of areas in which additional research and testing is needed, and in which present knowledge is insufficient to permit hard and fast procedures to be established. GRA

N79-29237# National Bureau of Standards, Washington, D. C. National Measurement Lab.
NBS STANDARD REFERENCE MATERIALS CATALOG, 1979-80 EDITION
R. W. Seward Apr. 1979 111 p Supersedes COM-75-10943 (PB-294666/3; NBS-SP-260; LC-79-600021; COM-75-10943) Avail: NTIS HC A06/MF A01 CSCL 07D

The Standard Reference Materials, Research Materials, and Special Reference Materials that are available from the National Bureau of Standards and those that are soon to be available are listed. The materials are described as to their certified characterization, unit size, and type, as well as providing ordering information. Prices for these materials are listed separately in annual supplements to this Catalog. GRA

24 COMPOSITE MATERIALS

Includes laminates.

N79-29238 Washington Univ., Seattle.
THE PRODUCTION AND USE OF CHITOSAN RELATED TO THE MANUFACTURE OF FIBER ASSEMBLAGES Ph.D. Thesis
James Richard Fox 1979 164 p
Avail: Univ. Microfilms Order No. 7917569

Chitosan was shown to be an effective strength additive for thermo-mechanical newsprint reinforced with kraft fibers. In the machine trial, the size press had several advantages over the spray method of applying chitosan solutions but both appeared to be technically feasible. The most notable advantage was that fains in tear factor were observed as opposed to the losses normally associated with spray methods. In terms of glass fibers, chitosan increased the dry strength threefold and tensile strength

by nearly 50 percent and at a 3.2 percent chitosan retention. Chitosan also demonstrated a high temperature capacity which could more than double the dry tensile strength of untreated glass fiber filters at 200 deg. Chitosan also significantly improved the wet web strength and retention of fines in thermo-mechanical pulp. Dissert. Abstr.

N79-29239 Pittsburgh Univ., Pa.
INFLUENCE OF ALUMINA DISPERSIONS ON THE HIGH TEMPERATURE CREEP OF POLYCRYSTALLINE SODIUM CHLORIDE Ph.D. Thesis
Rakesh Kumar Sinha 1978 145 p
Avail: Univ. Microfilms Order No. 7917455

Creep experiments, under compression, were performed on NaCl samples containing varying amounts of alumina dispersions at temperatures in the range of 0.8 Tm and at stress levels below approximately 0.5 x 10 to the -4 power G. Al2O3 powders with two different particle sizes were used. A treatment was developed to show that stress dependence of creep rate is indicative of a threshold stress. A model for diffusive creep controlled by particle inhibited grain boundary sliding gives a stress exponent of 1, an activation energy equal to that for the grain boundary diffusion of the rate controlling species and predicts a strain rate insensitive to the grain size. The creep behavior of the NaCl samples containing a dispersion of alumina is consistent with the stress temperature and grain size dependence predicted by this model. The experimentally observed rate is within an order of magnitude agreement with that calculated theoretically with this model. Dissert. Abstr.

N79-29240*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
HIGH CHAR IMIDE-MODIFIED EPOXY MATRIX RESINS
Tito T. Serafini, Peter Delvigs, and Raymond D. Vannucci 1979 12 p refs Proposed for presentation at 11th Natl. SAMPE Tech. Conf., Boston, 13-15 Nov. 1979
(NASA-TM-79226; E-123) Avail: NTIS HC A02/MF A01 CSCL 11D

The synthesis of a class of bis(imide-amine) curing agents for epoxy matrix resins is discussed. Glass transition temperatures and char yield data of an epoxy cured with various bis(imide-amines) are presented. The room temperature and 350 F mechanical properties, and char yields of unidirectional graphite fiber laminates prepared with conventional epoxy and imide-modified epoxy resins are presented. A.R.H.

N79-29241*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
MOISTURE DIFFUSION PARAMETER CHARACTERISTICS FOR EPOXY COMPOSITES AND NEAT RESINS
Edward R. Long, Jr. Aug. 1979 30 p refs
(NASA-TP-1474; L-12629) Avail: NTIS HC A03/MF A01 CSCL 11D

The moisture absorption characteristics of two graphite/epoxy composites and their corresponding cured neat resins were studied in high humidity and water immersion environments at elevated temperatures. Moisture absorption parameters, such as equilibrium moisture content and diffusion coefficient derived from data taken on samples exposed to high humidity and water soak environments, were compared. Composite swelling in a water immersion environment was measured. Tensile strengths of cured neat resin were measured as a function of their equilibrium moisture content after exposure to different moisture environments. The effects of intermittent moderate tensile loads on the moisture absorption parameters of composite and cured neat resin samples were determined. Author

N79-29242# United Technologies Research Center, East Hartford, Conn.
FABRICATION AND EVALUATION OF LOW COST ALUMINA FIBER REINFORCED METAL MATRICES Final Technical Report, 1 Jul. 1975 - 30 Nov. 1978
Karl M. Prewo Jan. 1979 41 p refs
(Contract N00014-76-C-0035)
(AD-A068448; UTRC/R79-912245-6) Avail: NTIS HC A03/MF A01 CSCL 11/2

Silicon carbide and alumina fiber reinforced aluminum matrix composites were evaluated and compared by tensile testing, three point bend flexural testing, elevated temperature exposure, thermal cycling, and instrumented pendulum impact. It was found that the silicon carbide/aluminum provided the higher level of axial tensile strength while the alumina/aluminum was superior in transverse tension. The difference in transverse strength was mainly due to the poor fiber-matrix bond existent in the silicon carbide/aluminum as compared to the very high strength bond in the alumina/aluminum composite. A very large difference in composite impact performance was found to be affected by the differences in fiber and matrix properties. In addition, measured composite impact energy dissipation capability was related to specimen test geometry as well as the relative levels of composite tensile and shear strengths. Both composite materials were also shown to suffer significantly due to either thermal cycling (SiC/aluminum) or constant elevated temperature exposure (alumina/aluminum). GRA

N79-29243# California Univ., Livermore. Lawrence Livermore Lab.
ENGINEERING APPROACH TO STATIC FATIGUE BEHAVIOR OF FLAWED FIBER-COMPOSITE LAMINATES
Satish V. Kulkarni 25 Jan. 1979 21 p refs Presented at Intern. Conf. on Fracture Mech. in Eng. Appl., Bangalore, India, 26-30 Mar. 1979 Submitted for publication
(Contract W-7405-eng-48)
(UCRL-81753; Conf-79037-2) Avail: NTIS HC A02/MF A01

Simplified, engineering-analysis models are presented for predicting the response of notched and unnotched fiber composite laminates subjected to static and fatigue tensile loadings. The static failure mode is an analytical idealization of the stress and damage distribution in a notched laminate. It avoids the study of extreme detail but models physically realistic failure modes. The failure predictions are compared with limited data for notched boron/epoxy laminates. A graded finite-element model is proposed to overcome certain limitations of the static-failure model. DOE

N79-29244# California Univ., Livermore. Lawrence Livermore Lab.
STRUCTURE-PROPERTY RELATIONS OF COMPOSITE MATRICES
R. J. Morgan 6 Sep. 1978 5 p refs Presented at the 177th ACS Natl. Meeting, Honolulu, Hawaii, 1 Apr. 1979
(Contract W-7405-eng-48)
(UCRL-81583; Conf-790415-7) Avail: NTIS HC A02/MF A01

Structure-property studies of epoxies that are commonly utilized as composite matrices are reviewed. The two systems primarily studied were: (1) diethylene triamine-cured bisphenol-A-diglycidyl ether epoxy (DGEBRA-DETA); and (2) diaminodi-phenyl sulfone-cured tetraglycidyl 4,4' diaminodiphenyl methane, epoxy (TGDDM-DDS). DOE

N79-29245# Oak Ridge National Lab., Tenn.
INFRARED AND RAMAN SPECTRA OF BORON IMPLANTED, LASER ANNEALED SILICON
H. Engstrom, J. B. Bates, R. T. Young, J. R. Noonan, and C. W. White Nov. 1978 6 p refs Presented at the AIP Conf. on Laser-Solid Interactions and Laser Process., Boston, 28 Nov. 1978
(Contract W-7405-eng-26)
(CONF-781167-4) Avail: NTIS HC A02/MF A01

Raman and infrared absorption spectra were obtained for boron implanted, pulse laser annealed silicon. Measurement of the shift in the silicon optic mode due to a Fano interaction has yielded a value of the utilization coefficient of 0.89 + or - 0.09 for a sample implanted with 10 to the 16th power ions/sq cm. Low energy infrared absorption is attributed mainly to interband transitions although other processes seem to be taking place as well. DOE

N79-29246# Oak Ridge National Lab., Tenn.
TRANSMISSION ELECTRON MICROSCOPY AND ELECTRICAL PROPERTIES MEASUREMENTS OF LASER DOPED SILICON AND GaAs
R. T. Young, J. Narayan, R. D. Westbrook, and R. F. Wood Dec. 1978 7 p refs Presented at the Laser-Solid Interactions and Laser Processing Symp., Boston, 28 Nov. - 1 Dec. 1978
(Contract W-7405-eng-26)

(CONF-781121-19) Avail: NTIS HC A02/MF A01

High quality silicon p-n junctions were prepared by alloying a vacuum evaporated Al film into n-type Si and by epitaxial regrowth of an As doped Si amorphous layer onto p-type (100) Si by a single short pulse of ruby laser radiation. Transmission electron microscopy investigations indicated that a defect free epitaxial layer was grown on the (100) Si surface; however, some polycrystalline structure in the very near-surface region was observed, which does not seem to affect the junction characteristics. Laser assisted junction formation in GaAs was demonstrated by alloying Mg films into n-type GaAs; however, diode characteristics show a large leakage current which may have been caused by the surface damage. DOE

N79-29247# Propellants, Explosives and Rocket Motor Establishment, Waltham Abbey (England).

BEHAVIOUR AND BENEFITS OF INTIMATELY MIXED HYBRID COMPOSITES

N. J. Parrat and K. D. Potter Nov. 1978 45 p refs

(PERME-TRE-81; BR66261) Avail: NTIS HC A03/MF A01

Starting from the constant strain theory of hybrid tensile strength, it is shown that in finely-mixed unidirectional hybrids the reinforcing strength of a set of fibers will assume higher values depending on their surroundings. In the case of hybrids of high modulus (HMS) carbon fibers, three characteritic levels of strength are predicted and indeed observed in the reported experiments. These levels are the mean fiber strength, the bundle strength referred to short gage length, and the brittle strength which is also observed in all HMS composites. Statistical coordination solutions are developed which predict the compositions of the average bundle and the bundle-brittle transitions and also the hybrid tensile strength. Author (ESA)

N79-29248# Research Inst. of National Defence, Stockholm (Sweden).

CONSTRUCTION USING CARBON FIBER COMPOSITE MATERIALS AND ALUMINUM: A COST COMPARISON Final Report [KONSTRUKTION I KOLFIBERKOMPOSIT OCH ALUMINIUM: EN KOSTNADSJAEMFOERELSE]

Bo Holmberg and Boerje Oestman Dec. 1978 13 p refs In SWAHILI

(FOA-C-20280-F9) Avail: NTIS HC A02/MF A01

A comparison of production costs for various aircraft parts using either carbon fiber composite materials or aluminum was made. The costs involved in the use of different construction techniques, the cost of materials, and the labor costs are discussed. Previous studies on wing panels and fuel tanks as well as several types of composite materials were considered. Results show that certain construction techniques make carbon fiber composites highly competitive as compared to aluminum. Author (ESA)

N79-29249# Bureau of Mines, Twin Cities, Minn.

STABILITY OF ALUMINA-BASE REFRACTORIES IN WESTERN LIGNITE-ASH SLAG ENVIRONMENTS

J. E. Pahlman, C. F. Anderson, and S. E. Khalafalla 1979 22 p refs

(PB-293238/2; BM-RI-8334) Avail: NTIS HC A02/MF A01 CSCL 11B

The use of Western lignites and subbituminous coals for firing pellet induration and metallization furnaces requires that the refractory linings of these furnaces be able to withstand attack from corrosive alkali metal oxides present in the ash of many of the low-rank fossil fuels. Dynamic and static slag tests on high-alumina and alumina-silica refractories show that increased alkali content in the lignite ash caused increased corrosion and erosion of the tested refractories. The degree of corrosion decreased with increasing alumina content, with the 99-percent-alumina refractories having the highest resistance. Also, porosity reduction and tar impregnation enhanced the corrosion and erosion resistance. GRA

25 INORGANIC AND PHYSICAL CHEMISTRY

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.

For related information see also *77 Thermodynamics and Statistical Physics.*

N79-29250 Stanford Univ., Calif.

IMPERFECT QUADRUPOLE MASS FILTERS FOR USE IN MASS SPECTROMETRY Ph.D. Thesis

Kenneth Louis Pocek 1979 163 p

Avail: Univ. Microfilms Order No. 7917274

A method was developed to model the performance of an imperfect quadrupole mass filter. The initial step is the calculation of the higher order multipole terms for the specific distortion. Then ion trajectories with these multiple terms are computed with a digital differential equation solver. These trajectories act as probes to delineate the shape of the quadrupole's acceptance surface. The acceptance surface of the quadrupole can be compared to the emittance of a variety of ion sources. The result is a model of the mass spectral peaks of the imperfect quadrupole. From these peak shapes the performance of a quadrupole mass filter with nonhyperbolic rods can be determined. Dissert. Abstr.

N79-29251 Michigan State Univ., East Lansing.

COMPUTER CONTROLLED COULOSTATIC INSTRUMENT AND ITS APPLICATION TO THE STUDY OF MERCURY FILM ON PLATINUM SURFACE Ph.D. Thesis

Minchen Wang 1978 231 p

Avail: Univ. Microfilms Order No. 7917805

A computer controlled coulostatic instrument was constructed and used to study mercury film formation on a platinum surface. On the platinum surface, three structures of mercury deposits were identified, namely; mercury droplets, mercury patches and smooth mercury films. The structure of the mercury film depended on the deposition overpotential and the pretreatment of the platinum prior to the mercury deposition. A new approach to plate a mercury film on a platinum surface was also devised. In this approach, the chloride ion was utilized as a masking agent during the mercury plating process. The chloride ion formed an insoluble calomel film on the deposited mercury surface which prevented the formation of mercury droplets. This approach was found to be quite effective for creating a thin smooth mercury film on the platinum surface. Dissert. Abstr.

N79-29252 Missouri Univ. -Kansas City.

STUDY OF SOME INORGANIC COMPOUNDS WITH PHOTOELECTRON SPECTROSCOPY Ph.D. Thesis

Fu Chung Chang 1979 180 p

Avail: Univ. Microfilms Order No. 7918402

Ultraviolet photoelectron spectroscopy was used to determine the valence shell spectra of dimethyl chalcogen compounds. Ionization energies were determined and compared to the values calculated by the extended Hueckel method. An ionization linear relationship of molecular binding energy of the compound and the ionization energy of the central element in that compound was found. Nickel(III) dimethylglyoxime was identified by X-ray photoelectron spectroscopy. The oxidation of cobaltous complexes of aminopolycarboxylic acids to their corresponding cobaltic complexes with potassium peroxymonosulfate was studied for the simple spectrophotometric determination of 10-100 ppm of cobalt. Their molar absorptivities and reduction potentials were determined. Dissert. Abstr.

N79-29253 State Univ. of New York at Stony Brook.

MULTIPHOTON IONIZATION SPECTROSCOPY: INTERATOMIC EFFECTS IN THE XENON SPECTRUM AND INTRAMOLECULAR EFFECTS IN THE BENZENE SPECTRUM Ph.D. Thesis

Kenneth Paul Aron 1979 201 p

Avail: Univ. Microfilms Order No. 7918046

The multiphoton ionization spectrum of xenon was taken in the vicinity of the laser wavelengths corresponding to one-third the energy of transitions of the 5p5 3s, 5p5 6s and 5p5 5d

atomic levels. Many atomic resonances were observed, the most prominent being third photon resonances with atomic 5d levels and fourth photon resonances with atomic 4f levels. However, peaks corresponding to ionization through the 6s levels were weak or absent. Resonances in these regions showed extreme pressure dependence. The MPI spectrum of benzene cooled in a seeded supersonic expansion was taken in the region of the two-photon transition as well as in two other regions, one of two-photon resonances and one of three photon resonances with benzene Rydberg states. Dissert. Abstr.

N79-29254 California Univ., Davis.
THERMODYNAMICS OF HYDROGEN-ISOTOPE-EXCHANGE REACTIONS Ph.D. Thesis
Carlos Hernan Contreras-Ortega 1979 185 p
Avail: Univ. Microfilms Order No. 7917150

The direct experimental determination of the equilibrium constant for the hydrogen-isotope-exchange reaction 1/2 D2(g) + HCl(hexOH) = DCl(hexOD) + 1/2 H2(g) (where hexOH is n-hexanol and hexOD is n-hexanol with deuterium substitution in the alcohol function) was made. The reaction was studied in electrochemical double cells without liquid junction. The design and operation of the vacuum line built to study the all-gas-phase hydrogen-isotope-exchange reaction 1/2 D2(g) + HCl(g) = DCl(g) + 1/2 H2(g) are reported. The best experimental conditions to study such a reaction were investigated. The reaction was studied in electrochemical double cells without liquid junction. Dissert. Abstr.

N79-29255 Michigan State Univ., East Lansing.
INVESTIGATIONS OF A SPARK EMISSION DETECTOR FOR GAS CHROMATOGRAPHIC ANALYSIS Ph.D. Thesis
Sandra Marie Koeplin 1978 203 p
Avail: Univ. Microfilms Order No. 7917735

The design, construction and operation of a spark emission gas chromatographic detector is described. The spark emission detector (SED) was shown to be useful for detection of boron, bromine, carbon, hydrogen, iodine, nitrogen, oxygen, phosphorus, silicon and sulfur with sensitivities in the microgram to nanogram range. The atomic emission lines, used to monitor emission, detection limits and dynamic range for each element investigated are presented. The SED was shown to be reliable to within 2.8% over five chromatographic separations and relatively free from effects due to carbon chain length or bond type. The software system design and FORTRAN 4 programs for the SED chromatographic system are described. The software package allows for control of a scanning monochromator for multielement analysis and a box-car integrator for time resolved spectroscopy. Dissert. Abstr.

N79-29256 California Univ., Davis.
ELECTROCHEMICAL SYSTEMS: AN ELEMENTARY PROCESSES APPROACH Ph.D. Thesis
Daniel Alberto Scherson 1979 133 p
Avail: Univ. Microfilms Order No. 7917176

The method presented allows the treatment of complex electrode reactions in a simple and unified fashion. Chronocoulometry in a stagnant solution is studied illustrating the dynamic coupling between a first order electrochemical reaction and mass transfer. This analysis is subsequently extended to account for hydrodynamic conditions in which a diffusion layer of finite thickness can be defined. A model of polarography is introduced yielding results which reproduce fairly accurately experimentally observed curves for properly chosen parameter values. The analysis of oscillatory electrochemical systems which include kinetic and electrical models and the foundations of linear stability analysis is outlined. Dissert. Abstr.

N79-29257 Pittsburgh Univ., Pa.
THE PREPARATION OF SECOND CLASS ELECTRODES FOR THE COULOMETRIC GENERATION AND POTENTIOMETRIC SENSING OF SUCH NEUTRAL SPECIES AS 1,10 PHENANTHROLINE AND ITS DERIVATIVES Ph.D. Thesis
Joseph N. Biber 1978 130 p
Avail: Univ. Microfilms Order No. 7917463

A method was developed for the coulometric generation of neutral molecules from a second class electrode. The neutral molecule studied most was 1,10 phenanthroline (phen) and the electrode was Ag. Ag phen2 NO3. An investigation is described, whereby suitable electrodes were prepared by anodizing silver in a solution that was 0.1 M in K2SO4, 0.1 M in phen and 0.02 M in KNO3. The generated 1,10 phenanthroline was used for the photometric determination of iron 2 and the potentiometric determination of nickel 2. The accuracy was approximately -4%(due to self dissolution)and the precision was 1%. Dissert. Abstr.

N79-29258 Virginia Univ., Charlottesville.
APPLICATIONS OF NEGATIVE ION CHEMICAL IONIZATION MASS SPECTROMETRY Ph.D. Thesis
Frank Warren Crow, Jr. 1978 251 p
Avail: Univ. Microfilms Order No. 7916226

Spectra using methane ion-molecular reactions to generate positive ions were compared with the negative ion spectra generated by thermal electron capture. Simple organic compounds such as hydrocarbons, alcohols, amines, aldehydes, ketones, acids, hydrides, esters and amines were surveyed. Applications to biological and environmental samples were investigated by sampling organophosphorous insecticides, chlorocarbons, sulfa drugs abused drug and toxins. Special attention was focused on derivatizing molecules with groups chosen to enhance the electron capture cross section for negative ion detection. Pentafluorobenzoyl derivatives of alcohols and pentafluorobenzoyl, pentafluorobenzylimine and tetrafluorophthalyl derivatives of amines were studied in particular with respect to their application to the catecholamine compounds. Dissert. Abstr.

N79-29259 Stanford Univ., Calif.
THE RHEOLOGY OF CONCENTRATED SUSPENSIONS Ph.D. Thesis
Francis Arturo Gadala-Maria 1979 151 p
Avail: Univ. Microfilms Order No. 7917233

The rheological properties of concentrated suspensions were studied by performing careful experiments on well-defined systems. Both steady shear and oscillatory shear experiments were conducted on suspensions of fairly large, uniformly sized polystyrene spheres in a mixture of silicone oils in which the particles are neutrally buoyant. These experiments were carried out in a Weissenberg Rheogoniometer using several flow arrangements. Dissert. Abstr.

N79-29260 Wisconsin Univ. - Madison.
THERMAL CONDUCTIVITY MEASUREMENT OF ARGON BY THE MACH REFLECTION METHOD Ph.D. Thesis
Kiyoung Chung 1978 193 p
Avail: Univ. Microfilms Order No. 7902392

A combustion driven planar shock wave was generated in the test gas. The shock wave was allowed to propagate down the duct and enter a test section, the floor of which was an inclined ramp. The interaction of the shock wave with the inclined ramp produced the tangential discontinuity flow behind the shock front in which two layers of the gas, each at a uniform velocity and temperature, move relative to another. The thermal mixing layer thickness associated with this flow was related to the thermal conductivity of the test gas through the Illingworth variable. The thickness of the thermal mixing layer was measured with a interferometer arranged in a Twymann-Green configuration. The thermal conductivity was then measured for the temperature range 3700 to 5350 K. The measurements correlated well with the results from a related but independent technique (the shock perturbation method). Dissert. Abstr.

N79-29261 Michigan State Univ., East Lansing.
SYNTHESIS, CHARACTERIZATION AND TLC-FLUORESCENCE ANALYSIS OF THE FLUORESCEINS FROM DICARBOXYLIC ACIDS Ph.D. Thesis
Zenaida Legaspi Chotorena 1978 144 p
Avail: Univ. Microfilms Order No. 7917759

The reaction of resorcinol with the dicarboxylic acids, succinic, 2,2 dimethylsuccinic, methylsuccinic, suberic adipic, pimelic and o-phthalic acids were studied so that the formation of their fluoresceins could be utilized in the quantitative determination of these acids by fluorimetry. The fluroesceins of the above mentioned acids were synthesized using as the condensing catalyst, sulfuric acid, polyphosphoric acid, p-toluene-sulfonic acid or Dowex 50W x 12. The fluoresceins were characterized by

taking their mass spectra, proton and carbon-13 NMR, adsorption and emission behavior, TLC chromatograms, and elemental carbon analysis. Yields from the use of the different condensing catalyst were determined and compared. Dissert. Abstr.

N79-29262# Environmental Data and Information Service, Washington, D. C.
WATER DESALINATION
Jul. 1979 11 p
(CIO-79-2; NOAA-S/T-79-43) Avail: NTIS HC A02/MF A01
A technological assessment of water desalination techniques and research is presented. R.E.S.

N79-29263# Washington State Univ., Pullman. Shock Dynamics Lab.
SHOCK-INDUCED DECOMPOSITION OF CARBON DISULFIDE Annual Summary Report, 1 Apr. 1978 - 31 Mar. 1979
George E. Duvall Apr. 1979 20 p refs
(Contract N00014-77-C-0232)
(AD-A068427; WSU-SDL-79-02) Avail: NTIS HC A02/MF A01 CSCL 07/2
The purpose of this work is to study the shock-induced chemical decomposition of liquid CS2. Studies of mechanical response have shown that the liquid under compression transforms to a higher density form. Past work has shown that this transformation occurs under static pressure at 45 kb and 175 C. Previous shock experiments have shown that a similar transformation occurs in a single shock at approximately 60 kb and 1000 C. Sheffield at WSU has shown that the transformation occurs in a reflected shock at pressures greater than 75 kb and at temperatures greater than 750 C. The transformation or reaction time was determined by Sheffield in various ways and found to decrease from about 400 nsec at 79 kb to less than 10 nsec at 130 kb. At the lower pressures there is an induction time decreasing from 300 nsec at 79 kb to less than 6 nsec at 106 kb. GRA

N79-29264# Florida Univ., Gainesville. Dept. of Chemistry.
ELECTROCHEMISTRY OF FUSED SALTS Final Report, 1 Mar. 1975 - 28 Feb. 1979
H. A. Laitinen 9 May 1979 42 p refs
(Grant DAHC04-75-G-0092)
(AD-A069104; ARO-P-12551.4-C) Avail: NTIS HC A03/MF A01 CSCL 07/4
The mechanism of electroreduction of chromate ion in LiCl-KCl melts is discussed. The chromium(V) species CrO4(3-), was isolated as its lithium salt which is sparingly soluble in the melt. This compound is regarded as an intermediate in the cathodic reduction of chromate. Its chemical reactions with divalent metal ions can be related to the formation of complex, nonstoichiometric double salts of chromium(III). Traces of moisture in LiCl-KCl melts were found to exert profound influences upon certain electrode processes. Molybdate in the presence of zinc chloride in LiCl-KCl melts gives Li2ZnMo2O8, which can be regarded as a compound of two MoO4(3-) ions packed into a lattice with Li(-) and Zn(2-). Antimony doped tin oxide is a useful anode material in LiCl-KCl melts. Eu(III)/Eu(II) and iron(III)/iron(II) show essentially reversible behavior whereas copper(II)-copper(I) and Pt(IV)/Pt(II) show abnormalities. Zirconia based solid electrolytes of various compositions have been tested as membranes for electrodes specific to oxide ions. Y2O3-stabilized zirconia proved to be the best electrolyte, responding almost in accordance with theory to oxide ion activity. GRA

N79-29265# Ballistic Research Labs., Aberdeen Proving Ground, Md.
THE H+O2 YIELDS OH+O REACTION, A COMPARISON OF POTENTIAL SURFACES
Arthur Gauss, Jr. Mar. 1979 28 p refs
(DA Proj. 1L1-61102-AH-43)
(AD-A069156; AD-E430221; ARBRL-TR-02148) Avail: NTIS HC A03/MF A01 CSCL 07/4
A new two Sato parameter LEPS surface has been developed for the HO2 system. The force constants and equilibrium geometry are in better accord with experiment than the corresponding properties of the previous single Sato parameter surfaces (Surfaces and I and I). Trajectory calculations have been run using the new surface for the H-O2 reaction O2 in initial vibrational states v=0,3,4 and 6. Results still indicate vibrational enhancement of the reaction rate but the magnitude of the enhancement is much less than for the previous surfaces. Specific rate constants are calculated and the overall thermal rate constant is estimated at 1600 and 2500 K. In addition a difficulty with the single parameter Surface I has been corrected yielding Surface 1. Specific rates and an overall rate are estimated using those surfaces as well. GRA

N79-29266# Air Force Engineering and Services Center, Tyndall AFB, Fla. Engineering and Services Lab.
THE AUTOXIDATION OF MONOMETHYLHYDRAZINE VAPOR Final Report, Jan. 1978 - Jan. 1979
Daniel A. Stone Apr. 1979 51 p refs
(AD-A069173; AFESC/ESL-TR-79-10) Avail: NTIS HC A04/MF A01 CSCL 13/2
Results of experiments simulating atmospheric autoxidation of monomethylhydrazine vapor are presented. MMH partial pressures ranged from a few ppm to a few Torr and all experiments were run at room temperature. Results show that the main products of MMH autoxidation in air are formaldehyde monomethylhydrazine, methane, methanol, nitrogen and water. The reaction rate appears to be heterogeneously controlled with surface activity and surface to volume ratio being important factors. MMH half life ranged from two to seven hours. GRA

N79-29267# Massachusetts Inst. of Tech., Cambridge. Dept. of Chemistry.
INSTABILITY AND FAR-FROM-EQUILIBRIUM STATES OF CHEMICALLY REACTING SYSTEMS Interim Report, 1 Dec. 1977 - 1 Dec. 1978
John Ross 7 Feb. 1979 26 p refs
(Grant AF-AFOSR-3214-77)
(AD-A068314; AFOSR-79-0471TR) Avail: NTIS HC A03/MF A01 CSCL 07/4
Recent progress is reported on hydrodynamic instabilities in binary fluids heated in a gravitational field from above and below; in the thermodynamic and stochastic formulation of stability in reactive systems far from equilibrium; in the statistical mechanics of stationary states; in the theory of unimolecular reactions; in the Franck-Condon approximation in chemical dynamics; in kinetic instabilities in first order phase transitions; and in experiments on reactions of excited species. GRA

N79-29268# New York Univ., N. Y. Dept. of Chemistry.
He(I) PHOTOELECTRON SPECTROSCOPY OF 1,2-ETHANEDIOL: COMPARISON OF GAS- AND LIQUID-PHASE SPECTRA
Ladislav Nemec, Lucille Chia, Hans Jasper Caehrs, and Paul Delahay Apr. 1979 13 p refs
(Contract N00014-75-C-0397)
(AD-A068334; TR-8) Avail: NTIS HC A02/MF A01 CSCL 07/3
He(I) photoelectron spectra of liquid 1,2-ethanediol were recently obtained by means of two different techniques: (i) irradiation of the liquid film on a rotating disk target and determination of energy distribution curves with a simple retarding potential cell; (ii) use of a liquid jet in conjunction with a conventional 127 degree analyzer. The liquid-phase spectra obtained by the two techniques are compared and discussed, and the second derivative curve (SDC) for the liquid-phase spectrum obtained by method (i) is compared with the gas-phase spectrum. GRA

N79-29269# National Bureau of Standards, Washington, D. C. Surface Science Div.
EVIDENCE FOR INCLINED CO ON Pd(210)
Theodore E. Madey, John T. Yates, Jr., A. M. Bradshaw, and F. M. Hoffmann 1 May 1979 20 p refs Submitted for publication Prepared in cooperation with Fritz-Haber Institut, Max-Planck-Gesellschaft
(Contract N00014-79-F-0002)
(AD-A068192; TR-9) Avail: NTIS HC A02/MF A01 CSCL 07/4
The ESDIAD method (Electon Stimulated Desorption Ion Angular Distributions) has been used to verify an unusual bonding configuration for CO adsorbed on the rather open Pd(210) surface.

In a previous infrared reflection-adsorption study of CO on Pd(210) (where top layer atoms with the nearest neighbor distance of 2.73 A do not exist) the results indicated that CO was bridge-bonded to two Pd atoms via the carbon atom. Such bridge-bonding can only occur in several distinct sites between atoms in the first and second atom layers, so that the axes of absorbed CO molecules are expected to be inclined away from the normal by approx. 18 deg. The ESDIAD data are consistent with the infrared observations at low coverages (two-fold symmetric triangular ESDIAD patterns dominated by off-normal ion emission in appropriate symmetry directions), but the results are more complex at higher coverages. At the saturation CO coverage at 90 K, the data indicate that CO is bonded normal to the surface. The relative yields of O(-) and CO(-) ions are sensitive to the bonding mode, with O(-) alone seen for bridge-bonded CO at low coverages and both O- and CO(-) ions observed at higher coverages. GRA

N79-29270# AeroChem Research Labs., Inc., Princeton, N. J.
IONIC MECHANISMS OF CARBON FORMATION IN FLAMES Annual Report, 1 Jan. - 31 Dec. 1978
H. F. Calcote, W. J. Miller, and D. B. Olson Apr. 1979 20 p refs
(Contract F49620-77-C-0029; AF Proj. 2308)
(AD-A068872; AeroChem-TP-382; AFOSR-79-0521TR; AR-2)
Avail: NTIS HC A02/MF A01 CSCL 21/2

An experimental program is underway to determine the mechanism of soot formation in flames, with particular emphasis on ionic mechanisms. Mass spectroscopic measurements of positive ion profiles through sooting and non-sooting, flat premixed flames show a large increase in the variety of ions produced when sooting occurs, with dramatic increases in the concentration of heavier ions as the combustion mixture is made fuel rich. In sooting flames, masses above 165 amu display two maxima in ion profiles through the flame. This has been confirmed by electrostatic probe measurements. The effect of changing the initial, and thus adiabatic flame temperature, on the critical equivalence ratio for soot formation was determined for acetylene and benzene. For acetylene the tendency to soot decreases with increasing adiabatic flame temperature; for benzene the tendency to soot first increases and then decreases. The data obtained in this program and data in the literature are interpreted in terms of a detailed ionic mechanism for soot formation in which chemi-ions grow by adding acetylene, polyacetylenes, and C2H. GRA

N79-29271# Department of Energy, Washington, D. C. Div. of Fossil Fuel Utilization.
SECOND ANNUAL COMBUSTION AND FUELS TECHNOLOGY PROGRAM CONTRACTOR REVIEW MEETING
1978 291 p refs Meeting held at Arlington, Va., 18-21 Sep. 1978
(CONF-7809103) Avail: NTIS HC A13/MF A01

Topics covered in papers presented at the meeting include combustion technology, waste fuel utilization, boilers and furnaces, internal combustion engines, engine optimization, exhaust emissions, effects of microwaves on combustion, swirl combustors, Raman scattering, laser spectroscopy uses in combustion research, alternative fuels, and residues and wastes. DOE

N79-29272# Los Alamos Scientific Lab., N. Mex.
SOME ASPECTS OF EQUATIONS OF STATE
H. L. Frisch Feb. 1979 15 p refs
(Contract W-7405-eng-36)
(LA-7591-MS) Avail: NTIS HC A02/MF A01

Some elementary properties of the equation of state of molecules repulsing each other as point centers of force are developed briefly. An inequality for the Lennard-Jones gas is presented. The scaled particle theory equation of state of hard spheres is also reviewed briefly. Means of possibly applying these concepts to represent thermodynamic data on model detonating gases are suggested. DOE

N79-29273# Ames Lab., Iowa.
INTERACTION OF CARBON MONOXIDE AND HYDROGEN WITH THE (1010) FACE OF RUTHENIUM Ph.D. Thesis - Iowa State Univ.
Terry Lee Tomcsik Jan. 1979 127 p refs
(Contract W-7405-eng-48)
(IS-T-854) Avail: NTIS HC A07/MF A01

The interaction was studied at 23.5, 200, and -135 C with low energy electron diffraction (LEED) and Auger electron spectroscopy. Carbon monoxide adsorbs associatively at 23.5 C, but is apparently dissociated by the LEED beam and hydrogen adsorbed from the ambient after a few minutes for less than 10 Langmuirs of carbon monoxide. For large doses of carbon monoxide at 23.5 C, 10 Langmuirs or more, the LEED beam does not disociate carbon monoxide, but carbon monoxide and hydrogen adsorbed from the ambient do appear to be removed from the surface by the LEED beam. Carbon monoxide and hydrogen on the surface together can react and form surface complexes with distinctive LEED patterns at 23.5 C though some of the interactions appear to be LEED beam induced. If sufficient hydrogen is present, some of these complexes are lost from the surface probably as methane and water. DOE

N79-29274# Mason and Hanger-Silas Mason Co., Inc., Amarillo, Tex.
HIGH SPEED GEL PERMEATION CHROMATOGRAPHY. 4: PRELIMINARY RESULTS ON SILICONE RESINS
E. Kohn and R. W. Ashcraft Feb. 1979 21 p refs
(Contract EY-76-C-04-0487)
(MHSMP-79-13-4) Avail: NTIS HC A02/MF A01

A feasibility study was conducted to determine the applicability of high speed gel permeation chromatography (HSGPC) to the analysis of silicones. The method yields significantly higher resolution compared with conventional GPC. A number of Dow-Corning silicone resins were analyzed by the HSGPC method and all samples exhibited complex distributions of either two partially resolved peaks or of a peak and a shoulder. A computer method was developed to deconvolute the chromatographic curves into their component peaks, which were Gaussian. It is feasible to determine functional groups, such as silicon hydride and vinyl-silicon for the individual components of the mixture, represented by a peak or a shoulder. Qualitative results were obtained by application of an infrared detector and use of tetrachloroethylene solvent. Further development is likely to yield a quantitative method of analysis for these functional groups. DOE

N79-29275# Iowa Univ., Iowa City. Dept. of Chemistry.
NEW TECHNIQUES FOR ANALYSIS OF ORGANIC POLLUTANTS IN DRINKING WATER Ph.D. Thesis - Iowa State Univ., Ames
Larry Dean Kissinger Jan. 1979 16 p refs
(Contract W-7405-eng-82)
(IS-T-845) HC A02/MF A01

An abstractor packing prepared by coating Chromosorb G AW/DMCS with copper(2) chloride was effective for removal of amines from gas chromatographic streams, but it did not affect the chromatographic behavior of nonamine compounds. By using precolumns packed with the abstractor packing, solventless chromatograms were obtained for samples in pyridine. A method was developed for determining haloforms in drinking water by sorption of the haloforms on columns packed with acetylated XAD-2. A precolumn of the abstractor packing was used to remove the pyridine solvent from the samples containing the haloforms concentrated from waters. Detection limits for the four chloro-, bromo- haloforms in a 100 ml water sample using an electron capture detector were below 1 ppB. Addition of ascorbic acid to chlorinated waters was effective for stopping the production of haloforms. DOE

N79-29276# Bureau of Mines, Rolla, Mo. Metallurgy Research Center.
CHEMICAL VAPOR DEPOSITION OF WEAR-RESISTANT COATINGS
J. B. Stephenson, D. M. Soboroff, H. O. McDonald, and A. A. Cochran 1979 14 p refs
(BM-RI-8348) Avail: NTIS HC A02/MF A01

The feasibility of hardfacing the critical surfaces of valves and similar devices by chemical vapor deposition was investigated in order to increase the wear resistance of these components for use in the abrasive and erosive environment of coal gasification units. Tungsten and molybdenum coatings were produced on nickel plated carbon steels and stainless steels by hydrogen

reduction of the metal hexafluoride at 325 to 600 C. Titanium nitride coatings were produced on low-carbon steels by the reaction of titanium tetrachloride, hydrogen, and nitrogen at 1,000 C. Titanium carbonitride coatings were produced on low-carbon steels by the reaction of nitrogen, hydrogen, and methane at 900 C. DOE

N79-29277# Wisconsin Univ., Stoughton. Synchrotron Radiation Center.
PHOTOELECTRON SPECTROSCOPY OF METAL DIHYDRIDES
J. H. Weaver and D. T. Peterson (Ames Lab., Iowa) 1979 7 p refs Presented at Hydrogen in Metals Intern. Meeting, Munster, West Germany, 6 Mar. 1979
(Contract W-7405-eng-82)
(IS-M-185) Avail: NTIS HC A02/MF A01

Synchrotron radiation was used for photoelectron spectroscopy studies of the trivalent and tetravalent dihydrides of Sc, Y, Lu, Er, and Zr. Results presented emphasize YH2. Comparisons are made between experiment and the theoretical results. It is shown that there is generally excellent overall agreement between theory and experiment. DOE

N79-29278# Electricite de France, Clamart. Div. Chimie Corrosion.
DEVELOPMENT OF A METHOD FOR SEPARATING TRACE METALLIC IMPURITIES FROM SODIUM BY VACUUM DISTILLATION [MISE AU POINT DE LA SEPARATION DE TRACES D'IMPURETES METALLIQUES CONTENUES DANS LE SODIUM PAR DISTILLATION SOUS VIDE]
C. Oberlin 26 Oct. 1978 23 p refs In FRENCH
(HT/PV/D/421-MAT/T-42) Avail: NTIS HC A02/MF A01

A vacuum distillation method for use in purifying sodium of trace metallic impurities was perfected and is intended to replace, for laboratory applications, the separation method based on coprecipitation after the dissolution of sodium in ethanol. The development work and laboratory apparatus are described in detail. Results are compared for the two methods and the vacuum distillation method is shown to be superior for accuracy and reproducibility. Applications of the method are demonstrated, for removing traces of calcium, chrome, iron, nickel, and manganesse. Eventually, the method may be used for purifying liquid sodium used in liquid metal cooled reactors. Author (ESA)

N79-29279# National Materials Advisory Board, Washington, D. C. Commission on Sociotechnical Systems.
MATRIX OF COMBUSTION-RELEVANT PROPERTIES AND CLASSIFICATION OF GASES, VAPORS, AND SELECTED SOLIDS
1979 99 p refs
(Contract DL-J-9-F-5-0070)
(PB-294250/6; NMAB-353-1) Avail: NTIS HC A05/MF A01 CSCL 06J

The classification assigned by the committee to certain chemicals in accordance with Article 500 to the National Electrical Codes is listed. The classification information is presented in the form of a matrix which lists physical and flammability data for the chemicals reviewed. The matrix is cataloged by chemical families. The chemicals in the matrix were taken from lists provided by the Occupational Safety and Health Administration and the U.S. Coast Guard. GRA

N79-29280# Ames Lab., Iowa.
INDUCTIVELY COUPLED PLASMA-ATOMIC EMISSION SPECTROSCOPY: PROMINENT LINES Final Report, Mar. 1977 - Feb. 1978
R. K. Winge, V. J. Peterson, and V. A. Fassel Mar. 1979 72 p refs
(PB-294211/8; EPA-600/4-79-017) Avail: NTIS HC A04/MF A01 CSCL 07D

Nearly every phase of environmental protection depends on a capability to identify and measure specific pollutants in the environment. As part of the research on the occurrence, movement, transformation, impact, and control of environmental contaminants, new techniques for identifying and measuring chemical constituents of water and soil were developed. The use of inductively coupled plasma (ICP)-atomic emission spectroscopy is expected to increase rapidly as analytical chemists confront new problems in elemental characterization. The prominent lines of the ICP emission spectra of some 70 elements as the first step in the development of a spectral atlas that would serve as a useful tool in the selection of analytical lines for this spectroscopic technique are reported. GRA

N79-29281# Bureau of Mines, College Park, Md. Metallurgy Research Center.
ELECTRODEPOSITION OF EROSION-RESISTANT TITANIUM DIBORIDE COATINGS
David R. Flinn, Frank X. McCawley, Gerald R. Smith, and Paul B. Needham, Jr. 1979 36 p refs
(PB-293234/1; BM-RI-8332) Avail: NTIS HC A03/MF A01 CSCL 11C

Methods to electrodeposit erosion-resistant titanium diboride coatings from molten alkali metal borate baths at 900 C are described. These coatings were shown to be highly resistant to material loss during impingement with high-velocity alumina and silicon carbide powders, and they show promise as protective coatings to reduce metal loss in erosive chemical environments, such as coal gasification systems. The most erosion-resistant coatings were prepared on nickel, Inconel, and molybdenum from an electrolyte containing LiBO2, NaBO2, Na2TiO3, and TiO2. The best coatings were deposited at current densities of approximately 200 ma/sq cm, using titanium or titanium diboride anodes. GRA

26 METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

N79-29282 Oregon State Univ., Corvallis.
FRACTURE ENERGIES OF ZIRCALOY AND SOME ZIRCONIUM ALLOYS Ph.D. Thesis
James C. Rawers 1979 153 p
Avail: Univ. Microfilms Order No. 7918679

Three-point bend and impact tests with Charpy V-notch samples provided an efficient and economical method of fracture evaluation of the alloys under investigation. The force-displacement curves were dissected into four distinct segments (yield, plastic, cracks, and tear) and the integrated energy values determined. The combination of stress values, energy values, and surface analyses made it possible to explain the fracture mechanism. Fracture toughness criteria could not be met for any orientation, for temperature as low as -200 C, for the thickness as great as 2.0 cm nor for phosphorus concentration as high as 360 ppm. As a substitute for fracture toughness values, energies were studied. Dissert. Abstr.

N79-29283 British Library Lending Div., Boston Spa (England).
THE DEPOSITION OF ALLOYED CHROMIUM COATINGS
N. S. Jonyceva and M. A. Sluger May 1979 11 p refs Transl. into ENGLISH from Koroze Ochr. Mater. (Prague), v. 15, no. 5, 1972 p 104-108
(BLL-RTS-11726) Avail: British Library Lending Div., Boston Spa, Engl.

An understanding of the composition of the baths and of the working conditions at the deposition of the alloyed coatings of Cr-Se, Cr-Se-Te, Cr-Mo, and Cr-Co is considered. Selenic acid showed a catalytic effect and increased the yield of the cathodic currents up to 45-47%. The microhardness of the alloys with Se coatings was lower than those with chromium coatings. M.M.M.

N79-29284 British Library Lending Div., Boston Spa (England).
CALCULATION OF THE CREEP RATE OF A LEAD ENCASEMENT CONTAINING A GLASS BODY UNDER THE INFLUENCE OF GRAVITY. CHANGE IN THE CREEP PROPERTIES OF A LEAD ENCASEMENT DUE TO A MECHANICAL IMPACT
Anders Samuelson and Goran Eklund Apr. 1978 27 p Transl. into ENGLISH of KBS-TR-85, Karn-Bransle-Sakerhet, Stockholm, 1978 27 p
(BLL-Risley-Tr-4066-(9091.9F); KBS-TR-85) Copyright. Avail: British Library Lending Div., Boston Spa, Engl.

A cylindrical glass body is enclosed in a lead encasement. Under the influence of gravity, the glass body floats up through the lead encasement and this is subject to creep strain. Calculations of a simplified case show that at a temperature of 60 C the thickness of the lead encasement above the glass body is halved in a time period of between 200 and 10 to the seventh power years. The time is substantially dependent on the grain size of the lead. A grain size of at least 1 mm was used. The calculations are uncertain but the simplified case gives an overvaluation of the deformation rate. Author

N79-29285 British Library Lending Div., Boston Spa (England).
CORROSION OF STAINLESS STEELS
Sigurd Lohmeyer Apr. 1979 11 p refs Transl. into ENGLISH from Galvanotechnik (West Ger.), v. 68, no. 2, 1977 p 114-122
(BLL-WH-426-(9091.9F)) Avail: British Library Lending Div., Boston Spa, Engl.

Various causes of failure of stainless steels are discussed, viz alloy components, cooling errors, incorrect tempering in brazing and welding, chemical attack, infection by foreign rust and foreign materials, cold forming, vibrations, material combinations, brazing, incorrect welding, insufficient after treatment of weld zones, and mechanical damage to surfaces in machining. M.M.M.

N79-29286 British Library Lending Div., Boston Spa (England).
THE DEVELOPMENT OF INTERNAL STRESS IN ALPHA TITANIUM COLD WORKED IN TENSION
J. Charrier and J. deFouquet Nov. 1978 13 p refs Transl. into ENGLISH from Mater. Sci. Eng. (Netherlands), v. 34, no. 1, 1978 p 91-96
(RAE-Lib-Trans-1994) Avail: British Library Lending Div., Boston Spa, Engl.

Relaxation tests on cold worked titanium are described. At low temperature the stress varies more rapidly than the shear modulus. Studies carried out on samples with different grain sizes showed that the hardening observed between 133 and 293 K has an intergranular origin and can be attributed to the formation of hydrides, with the most probable hardening mechanism being of the Orowan type. M.M.M.

N79-29287 Pittsburgh Univ., Pa.
SOLVENT EFFECTS ON KINETICS AND THERMODYNAMICS OF COMPLEXATION OF NICKEL(2) AND IRON(3) Ph.D. Thesis
Costas G. Karakatsanis 1978 121 p
Avail: Univ. Microfilms Order No. 7917479

Rate constants and activation parameters for the reactions of nickel (2) ion with various pyridine-type ligands in ethanol, 1-propanol, 2-propanol and isobutyronitrile as solvents are presented. The results are compared with those obtained in all other solvents studied so far. Results of ligand substitution at nickel (2) ion in solvent mixtures of 2-propanol with noncoordinating diluents such as benzene or methylene chloride are also presented. Properties of the solvent influencing the kinetics of complexation of nickel (2) are discussed. Results of a second study dealing with the thermodynamics of the nickel (2)-4-phenylpyridine system in a variety of solvents are presented. From the spectrophotometrically obtained equilibrium constants and formation rate constants, dissociation rate constants are calculated. Dissert. Abstr.

N79-29288 Princeton Univ., N. J.
MEASUREMENT OF THE CRITICAL EXPONENT BETA IN FERROMAGNETIC ALLOYS Ph.D. Thesis
Robert G. Browne 1979 92 p
Avail: Univ. Microfilms Order No. 7918552

The transmission of microwave power through thin ferromagnetic samples is studied for temperatures just below the critical temperatures, with no external magnetic field present. The microwave frequency is 9.212 GHz (X-band). The magnetization is deduced from the transmitted power using the Bloch-Bloemberger, equation to describe the spin dynamics. It was concluded that the addition of nonmagnetic impurities to nickel is an irrelevant parameter in the critical region and thus there is a universality of the critical exponents. Dissert. Abstr.

N79-29289 State Univ. of New York at Stony Brook.
DIFFUSION CONTROLLED INTERFACE MOVEMENT IN BINARY MULTIPHASE SYSTEMS AND ITS APPLICATION TO THE KINETICS OF FORMATION AND DEGRADATION OF ALUMINIDE COATINGS ON NICKEL Ph.D. Thesis
Amit Kumar Sarkhel 1979 186 p
Avail: Univ. Microfilms Order No. 7916876

Mathematical models were developed, and applied by means of analytical and numerical techniques, to investigate theoretically the kinetics of formation and degradation of aluminide coatings on Ni, and to interpret experimental data on pack aluminization of Ni. A numerical solution scheme was developed to predict the growth-rate and the composition profile in NiAl-based coatings. The diffusional degradation of NiAl-based coatings at 800-1200 C was simulated by a mathematical model based on finite, planar-geometry multiphase interdiffusion. The time of complete conversion of the protective NiAl layer, due to the growth of the underlying Ni3Al and substrate phases, is defined as the coating life. A comparison of the diffusional degradation rate with that of oxidative processes reveals that, at least for binary Ni(Al) substrates, the former is more important. Dissert. Abstr.

N79-29290 Minnesota Univ., Minneapolis.
KINETICS OF BIMOLECULAR REACTIONS ON PLATINUM Ph.D. Thesis
John William Blieszner 1979 194 p
Avail: Univ. Microfilms Order No. 7918319

Reaction rate behavior for the water gas shift reaction, and hydrogen oxidation on polycrystalline platinum is examined. Rates were measured at pressures less than 10 torr in a pyrex flow reactor, with gas partial pressures monitored continuously by a quadrupole mass spectrometer. The water gas shift reaction rate displays both first order and negative first order CO pressure dependence, and is one of few examples where shifting order is experimentally observed in a bimolecular reaction with competitive adsorption. The dependence on water vapor pressure is half order, and constant parameter one-state kinetics are used to fit the experimental data. The reaction rate of hydrogen oxidation is first order in oxygen at low pressures, but autothermal ignition limits the pressure in excess oxygen at which rates may be measured at low conversion. Dissert. Abstr.

N79-29291 Washington Univ., Seattle.
THE EFFECT OF STRESS REDUCTIONS DURING STEADY STATE CREEP IN HIGH PURITY ALUMINUM Ph.D. Thesis
Iris Ferreira 1978 162 p
Avail: Univ. Microfilms Order No. 7917565

The relationship between the strain-time behavior after stress reductions and accompanying changes in internal dislocation structure was the subject of considerable discussion in recent literature. In an attempt to resolve this controversy, constant stress creep tests and stress reduction experiments were conducted in high purity aluminum at stresses between 3.44 MPa and 15 MPa and at test temperatures between 523K and 623K. All experiments were conducted in a region of stress and temperature in which creep deformation is believed to be due to the diffusion-controlled motion of dislocations. The stress sensitivity n, which describes the steady state creep rate, was found to be n = 4.6 + or - 0.2, and the activation energy for steady state creep Q = 1.43 + or - 0.05 eV/at., were in excellent agreement with data reported in the literature. Dissert. Abstr.

N79-29292*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
AN EXPERIMENTAL, LOW-COST, SILICON SLURRY/ALUMINIDE HIGH-TEMPERATURE COATING FOR SUPERALLOYS
Stanley G. Young and Daniel L. Deadmore Jul. 1979 24 p refs
(NASA-TM-79178; E-045) Avail: NTIS HC A02/MF A01 CSCL 11F

A duplex silicon-slurry/aluminide coating has been developed and cyclically tested in Mach 1 combustion gases for oxidation and thermal fatigue resistance at 1093 C and in Mach 0.3 gases for hot-corrosion resistance at 900 C. The base-metal superalloys were VIA and B-1900. The coated B-1900 specimens

performed much better in oxidation than similar specimens coated with aluminides and almost as well as the more-expensive Pt-Al and MCrAlY (where M is Ni and/or Co) coatings deposited by the physical vapor deposition process. The coating also provided good hot-corrosion protection. Metallographic, X-ray, and electron microprobe studies were made to characterize the coating, determine failure mechanisms, and study some of the changes due to exposure. Author

N79-29293*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

EFFECTS OF YTTRIUM, ALUMINUM, AND CHROMIUM CONCENTRATIONS IN BOND COATINGS ON THE PERFORMANCE OF ZIRCONIA-YTTRIA THERMAL BARRIERS

Stephan Stecura Jul. 1979 30 p refs
(NASA-TM-79206; E-091) Avail: NTIS HC A03/MF A01 CSCL 11F

A cyclic furnace study was conducted between 990 - 280 C and 1095 - 280 C to evaluate the effects of yttrium, chromium, and aluminum concentrations in nickel base alloy bond coatings and also the effect of the bond coating thickness on the performance of yttria-stabilized zirconia thermal barrier coatings. The presence and the concentration of yttrium is very critical. Without yttrium, rapid oxidation of Ni-Al, Ni-Cr, and Ni-Cr-Al bond coatings causes zirconia thermal barrier coatings to fail very rapidly. Concentrations of chrominum and aluminum in Ni-Cr-Al-Y bond coating have a very significant effect on the thermal barrier coating life. This effect, however, is not as great as that due to yttrium. Furthermore, the thickness and the thickness uniformity also have a very significant effect on the life of the thermal barrier system. Author

N79-29294# Air Force Materials Lab., Wright-Patterson AFB, Ohio.

BRAZING OF HASTELLOY X WITH WIDE CLEARANCE BUTT JOINTS Final Report, Jan. 1977 - Jul. 1978

Jack W. Chasteen and Guinn E. Metzger Mar. 1979 70 p
(AF Proj. 2747)
(AD-A068254; AFML-TR-79-4026) Avail: NTIS HC A04/MF A01 CSCL 11/6

Wide clearance butt joints of Hastelloy X base metal were vacuum furnace brazed by first sintering a nickel base powder of high melting point (sinter filler metal) in the joint. This was followed by filling the powder interstices with a nickel base brazing filler metal and a diffusion treatment. Various combinations of sinter filler metals and brazing filler metals were studied by the production and examination of small wafers, which were sintered and brazed. These studies proved to be an efficient means of obtaining valuable information regarding the subsequent fabrication of brazed joints. A technique for brazing butt joints of consistent high quality, with virtually unlimited joint clearance, was developed. GRA

N79-29295# Air Force Materials Lab., Wright-Patterson AFB, Ohio.

AN ANALYSIS OF THE LOW CYCLE FATIGUE BEHAVIOR OF THE SUPERALLOY RENE 95 BY STRAINRANGE PARTITIONING Technical Report, Jan. 1977 - Jan. 1978

J. M. Hyzak and Henry L. Bernstein Nov. 1978 60 p refs
(Contract F33615-76-C-5191)
(AD-A068252; AFML-TR-78-174) Avail: NTIS HC A04/MF A01 CSCL 11/6

This report describes the results of a research program to examine the applicability of the Strainrange Partitioning (SRP) method for predicting high temperature low cycle fatigue (LCF) crack initiation. Strain controlled LCF tests were performed at 922K (1200 F) on Rene 95, a high strength nickel-base superalloy, and SRP was used to correlate the data, as well as, to predict the number of LCF cycles to failure for a series of validation tests. The data indicate that for Rene 95 compressive dwell cycles are more damaging than tensile dwell cycles, and the LCF behavior depends largely on the time in tension per cycle and on the value of the maximum tensile stress. SRP was unable to satisfactorily predict the cyclic life for several types of LCF tests because the model is not capable of accounting for particular aspects of the alloys cyclic behavior, particularly the development of mean stresses. GRA

N79-29296# Massachusetts Inst. of Tech., Cambridge. Dept. of Chemistry.

THE PREPARATION OF ALLYLIC DERIVATIVES OF TIN BY WITTIG REACTIONS OF B-TRIMETHYLSTANNYL-ETHYLIDENETRIPHENYLPHOSPHORANE

Dietmar Seyferth, Karl R. Wursthorn, and Robert E. Mammarella May 1979 27 p refs
(Contract N00014-76-C-0837)
(AD-A068439; TR-4) Avail: NTIS HC A03/MF A01 CSCL 07/3

In recent years allylic derivatives of tin have found increasing applications in organic and organometallic synthesis. Among the methods used previously to prepare allyltin compounds, the reaction of an allylic halide-derived Grignard reagent, preformed or generated in situ by the Barbier procedure, with a tin halide, the reaction of an allylic halide with an organotinlithium or -sodium reagent, and the radical-initiated 1,4-addition of a tin hydride to a 1,3-diene are the most important. GRA

N79-29297# California Univ., Berkeley. Dept. of Mechanical Engineering.

ANALYSIS OF AXISYMMETRIC SHEET-METAL FORMING PROCESSES BY THE RIGID-PLASTIC, FINITE-ELEMENT METHOD Technical Report, Jun. 1977 - Jun. 1978

J. H. Kim, S. I. Oh, and Shiro Kobayashi Sep. 1978 148 p refs
(Contract F33615-77-C-5111; AF Proj. 2418)
(AD-A068250; AFML-TR-78-120) Avail: NTIS HC A07/MF A01 CSCL 13/8

This report describes the development of a finite-element model for analyzing sheet-metal forming processes. Materials are assumed to be rigid-plastic with the view that the usefulness of an analysis method depends largely upon solution accuracy and computation efficiency. First, the variational formulation applicable to sheet-metal forming is described by considering solution uniqueness and the effect of geometry change involved in the following processes. From this variational formulation, a finite-element process model based on the membrane theory is developed. Then, three basic sheet-metal forming processes, namely, the bulging of a sheet subject to hydrostatic pressure, the stretching of a sheet with a hemispherical head punch, and deep drawing of a sheet with a hemispherical head punch, are solved. The solutions arrived at by the rigid-plastic, finite-element method are compared with existing numerical solutions and the experimental data. The agreement is generally excellent and it is concluded that the rigid-plastic, finite-element method is efficient for analyzing sheet-metal forming problems with reasonable accuracy. GRA

N79-29298# Ballistic Research Labs., Aberdeen Proving Ground, Md.

THE EPSILON-PHASE HUGONIOT OF ROLLED HOMOGENEOUS ARMOR Final Report

George Hauver and Angelo Melani Mar. 1979 26 p refs
(DA Proj. 1L6-62618-AH-80)
(AD-A069107; AD-E430226; ARBRL-MR-02909) Avail: NTIS HC A03/MF A01 CSCL 19/4

The epsilon-phase Hugoniot of rolled homogeneous armor (RHA) has been determined by impact experiments and compared with the epsilon-phase Hugoniot of iron. Results for RHA suggest a slightly greater volume offset at the alpha-epsilon phase transformation and slightly stiffer behavior at higher stresses. Risetime of the second plastic wave and attenuation of the first plastic wave are in close agreement for RHA and iron, suggesting similar transformation kinetics. GRA

N79-29299# Naval Research Lab., Washington, D. C. Thermostructural Materials Branch.

SIGNIFICANCE OF COPPER, PHOSPHORUS, AND SULFUR CONTENT TO RADIATION SENSITIVITY AND POSTIRRADIATION HEAT TREATMENT OF A302-B STEEL Final Report

J. R. Hawthorne 12 Apr. 1979 26 p refs
(Contract NRC-RES-79-103)
(AD-A068696; NRL-8264; NUREG-CR-0327) Avail: NTIS HC A03/MF A01 CSCL 11/6

The effects of three levels of copper content and phosphorus content and two levels of sulfur content on radiation sensitivity

and postirradiation heat treatment response were explored for a reactor pressure vessel steel, Type A302-B. Test plates for the investigation were produced from 182-kg (400-lb) laboratory melts. The contributions of individual elements were assessed from Charpy-V (C sub v) notch ductility changes with 288 C (550 F) irradiation and with a 343 C (650 F)-168 h postirradiation heat treatment. Limited studies of properties recovery by postirradiation 399 C (750 F) heat treatment were also made. Radiation embrittlement sensitivity, as shown by C sub v transition-temperature elevation and C sub v upper-shelf reduction, generally increased with increased-copper and phosphorus content and with decreased sulfur content. Certain ranges of phosphorus and copper content were found to be more critical than others. GRA

N79-29300# Pratt and Whitney Aircraft Group, West Palm Beach, Fla. Government Products Div.

HOT SALT STRESS CORROSION STUDIES Final Report, 1 Apr. 1976 - 1 Jun. 1978

R. L. Fowler Jun. 1978 58 p refs

(Contract F33615-76-C-5155; AF Proj. 7353)

(AD-A068402; PWA-FR-10247; AFML-TR-78-121) Avail: NTIS HC A04/MF A01 CSCL 11/6

Effects of various flight-cycle simulations, maximum temperature, and microstructure were investigated using a concept analogous to a low-cycle fatigue (LCF) study. Isothermal stress cycling increased HSSC threshold stress over static loading. Simultaneous stress/temperature cycling increased threshold stress (and cyclic life) over isothermal stress cycling. A simple takeoff/shutdown dwell simulation produced the highest test results of the thermal-mechanical cycles investigated, with no significant effect from the addition of idle and cruise components. HSSC susceptibility increased with increasing maximum cyclic temperature. Alpha-beta processed material showed better resistance to HSSC than did beta material. GRA

N79-29301# Pratt and Whitney Aircraft, West Palm Beach, Fla. Government Products Div.

SUPERALLOY FILLER METAL OPTIMIZATION Final Report, 15 Sep. 1977 - 15 Aug. 1978

W. H. King and D. W. Anderson AFML Wright-Patterson AFB, Ohio 31 Dec. 1978 87 p refs

(Contract F33615-77-C-5157; AF Proj. 2418)

(AD-A068450; PWA-FR-10621; AFML-TR-78-177) Avail: NTIS HC A05/MF A01 CSCL 11/6

Pratt and Whitney Aircraft has conducted a two-phase program to optimize an age-hardenable nickel-base filler metal composition for hot-cracking-limited superalloy applications. The approach used was to characterize critical filler metal properties (e.g., melting behavior) and weldability behavior and to use these results to iteratively optimize a filler metal composition. Starting compositions were based on the best filler metals developed previously under AF Contract. In Phase I, an optimum filler metal composition was determined. In Phase II, the optimum composition was evaluated by welding actual hardware and by conducting mechanical property tests. GRA

N79-29302# Ames Lab., Iowa.

DIRECTIONAL SOLIDIFICATION OF FILAMENTARY SHAPES OF Pb-Cd AND Pb-Sn EUTECTIC ALLOYS

B. K. Dhindaw, J. D. Verhoeven, C. R. Spencer, and E. D. Gibson 1978 8 p refs Presented at Mater. Res. Soc. Ann. Meeting, Boston, Nov. 1978

(Contract W-7405-eng-82)

(IS-M-179; Conf-7811115-1) Avail: NTIS HC A02/MF A01

Eutectic alloys of PbCd and PbSn were directionally solidified as thin filamentary strips contained in stainless steel and quartz capillaries. As the solidification rate increased the filament width, w, was reduced to maintain complete alignment of the lamellae clear across the filament. It was determined that in order to achieve complete alignment the ratio of filament width to lamellar spacing, w/lambda had to be less than about 30. Experiments were carried out at rates of 2-400 microns per sec/s and at temperature gradients of 130 and 320 C/cm. DOE

N79-29303# Brookhaven National Lab., Upton, N. Y.

FIRST PRINCIPLES BAND THEORY FOR RANDOM METALLIC ALLOYS

B. L. Gyorffy and G. M. Stocks (ORNL) 1978 129 p refs

(Contract W-7405-eng-26; EY-76-C-02-0016)

(TID-29436) Avail. NTIS HC A07/MF A01

The format structure, results, and applications of the band theory of random alloys are discussed for a lecture program. Author (DOE)

N79-29304# Virginia Univ., Charlottesville. Dept. of Materials Science.

IN-SITU HVEM FRACTURE STUDIES OF NEUTRON AND HELIUM ION IRRADIATED STAINLESS STEEL

J. A. Horton, J. I. Bennetch, and W. A. Jesser 1979 5 p refs Presented at 1st Topical Meeting on Fusion Reactor Mater., Miami Beach, Fla., 29 Jan. 1979

(Contract EY-76-S-05-5013)

(UVA-CTR-11; Conf-790125-27) Avail: NTIS HC A02/MF A01

Tensile tests on irradiated stainless steel samples were performed in a 500 kV transmission electron microscope. The tests were carried out to fracture while the specimen was under observation. Tests were conducted on unirradiated type 361 stainless steel, neutron irradiated type 304 stainless steel, and helium ion irradiated type 316 stainless steel. The neutron irradiated samples were irradiated to a fluence of 1.0 x 10 to the 23rd power sq cm. The helium ion irradiated samples were irradiated with an 80 keV helium ion beam at fluxes of 3 x 10 to the 14th power sq cm/sec while the sample was being pulled in the microscope. The test temperatures were 25 and 600 C. DOE

N79-29305# Argonne National Lab., Ill. Materials Science Div.

CORROSION OF METALS IN COAL-GASIFICATION ENVIRONMENTS

K. Natesan 1979 50 p refs Presented at Conf. on Corrosion-Erosion of Coal-Conversion System Mater., Berkeley, Calif., 24-26 Jan. 1979

(Contract W-31-109-eng-38)

(CONF-790145-2) Avail: NTIS HC A03/MF A01

Thermodynamic aspects of high temperature corrosion processes that pertain to coal conversion were discussed, and kinetic data were used to compare the behavior of different commercial materials of interest. Regimes for corrosion protection via oxide formation on the materials were defined relative to alloy chemistry, oxygen and sulfur partial pressures in the gas environment, and temperature. Areas of additional research with particular emphasis on alloy design for improved corrosion resistance were identified. DOE

N79-29306# Illinois Univ., Urbana.

LOW TEMPERATURE ULTRASONIC STUDY OF HYDROGEN IN NIOBIUM Ph.D. Thesis - Ill. Univ. at Urbana-Champaign

David Brian Poker 1979 159 p refs

(Contract EY-76-C-02-1198)

(COO-1198-1247) Avail: NTIS HC A08/MF A01

Measurements were made of the velocity and attenuation of ultrasonic waves in niobium containing 1000 ppM oxygen with additional concentrations of hydrogen, to determine the properties of a relaxation of the hydrogen which appears below 10 K. Measurements were made as a function of temperature, frequency, polarization of the ultrasonic wave, hydrogen isotope, and concentration of hydrogen and oxygen. The Birnbaum-Flynn model of hydrogen tunnelling is modified to take into account the trapping of hydrogen by interstitial impurities. An Orbach process is proposed for a relaxation between the degenerate first excited states. DOE

N79-29307# California Univ., Livermore. Lawrence Livermore Lab.

DUCTILE FRACTURE OF ALUMINUM TENSILE SPECIMENS

M. L. Wilkins 5 Feb. 1979 12 p refs Presented at the Intern. Conf. on Fracture Mech. in Eng. Appl., Bangalore, India, 26 Mar. 1979

(Contract W-7405-eng-48)

(UCRL-81751; Conf-790307-3) Avail: NTIS HC A02/MF A01

Tension tests of a flat plate with a central slot and notched cylindrical bars were simulated on the computer to trace the spread of plasticity from a center of stress concentration until general large-scale yielding occurs. The two- and three-dimensional finite-difference programs HEMP and HEMP 3D were used to model the tension tests. Incremental plasticity theory follows to describe large deformation with rotation. The Von Mises hypothesis was applied in a manner to satisfy implicity the flow law that requires the plastic strain-rate vector to be normal to the yield surface. The plasticity function for describing work hardening was developed from simple tension-test experiments with 6061-T6 aluminum. Simulations were compared with experiments to study stress-strain conditions prior to ductile fracture. A computer model for predicting the initiation and propagation of ductile fracture was developed. DOE

N79-29308# California Univ., Berkeley. Lawrence Berkeley Lab.

MICROSTRUCTURES AND PHASE TRANSFORMATIONS IN INTERSTITIAL ALLOYS OF TANTALUM Ph.D. Thesis

U. Dahmen Jan. 1979 138 p refs

(Contract W-7405-eng-48)

(LBL-8661) Avail: NTIS HC A07/MF A01

Using advanced techniques of electron microscopy and ultrahigh vacuum technology, an understanding of the microstructures and phase transformations in dilute interstitial tantalum-carbon alloys is developed. Through a number of control experiments, the role and sources of interstitial contamination in the alloy preparation (and under operating conditions) are revealed. It was shown that all previously published work on the dilute interstitially ordered phase Ta64C can be explained consistently in terms of ordering of the interstitial contaminants oxygen and hydrogen, leading to the formation of the phases Ta12O and Ta2H. DOE

N79-29309# Electricite de France, Clamart. Div. Essais Mecanique.

CHARACTERIZATION OF THE FRACTURE MECHANICS IN Fe-Cr-Ni AUSTENITIC ALLOY TUBING WITH FAILURE INDUCED BY CORROSION UNDER STRESS IN A CAUSTIC ENVIRONMENT [ETUDE SUR EPROUVETTES DU TYPE MECANIQUE DE LA RUPTURE DE LA CORROSION SOUS TENSION EN MILIEU CAUSTIQUE DES ALLIAGES AUSTENITIQUES Fe-Cr-Ni]

G. Rousselier 27 Jul. 1978 37 p refs In FRENCH

(HT/PV/D/413-MAT/T-43) Avail: NTIS HC A03/MF A01

Corrosion tests under stress at 350 C in 100 g/l caustic soda were carried out on double cantilever beam and wedge opening loading test tubing of stainless steel, type 18-10 with molybdenum, alloys 800 and 600 before and after 8 thermal treatment of 16 h at 700 C. Crack propagation speed and noncrack thresholds K sub ISCC were evaluated. Results were applied to cracks in Inconel 600 tubes for boilers, concluding that thermal treatment considerably reduces the risk of fast crack propagation. Author (ESA)

N79-29310# Societe Nationale d'Etude et de Construction de Moteurs d'Aviation, Corbeil (France). Div. Metallurgie Resistance.

HIGH TEMPERATURE CORROSION MECHANISMS OF REFRACTION ALLOYS European Concerted Action. COST 50 - Materials for Gas Turbines, Project F-1/1. Final Report [MECANISMS DE CORROSION D'ALLIAGES REFRACTAIRES A HAUTES TEMPERATURES]

Yves Bourhis and Rene Morbioli 21 Nov. 1977 36 p In FRENCH Prepared in cooperation with l'Ecole des Mines de Paris

(SNECMA-42-118) Avail: NTIS HC A03/MF A01

The behavior of the nickel based alloys IN-100, INCO 713 LC, MAR-M 002m INCO 738 LC, IN 597, and Udimet 710 exposed to an environment with various concentrations of sulfur, sodium chlorine and vanadium was studied. Corrosion as a function of time was determined, paying particular attention to the role of Mo in alloys with Low Cr content. A measuring device was used to obtain the natural resonance frequency of the samples and so characterize mechanical degradation phenomena originating in the corrosion of the surface layers. Results show the influence of Na content on the sulfuration phenomena as well as the contribution of Va content to alloy corrosion. Natural frequency measurements agree in general with those obtained in thermobalance. It was found that the negative corrosion effect of Mo was less when testing on a corrosion bank subjected to thermal cycles. This is due to the volatilization of molybdenum oxide. Author (ESA)

N79-29311# Centre Technique des Industries Mecaniques, St. Denis (France).

RAPID MEASUREMENT OF RESIDUAL AUSTENITE BY AN ENERGY DISPERSION TECHNIQUE Final Report [MESURE RAPIDE DE LA TENEUR EN AUSTENITE RESIDUELLE PAR DISPERSION D'ENERGIE]

F. Lecroisey and B. Miege 15 Jul. 1978 57 p refs In FRENCH

(CETIM-1-5A-07-0) Avail: NTIS HC A04/MF A01

An X-ray diffraction method for characterizing austenitic steels after quenching was studied in order to determine its precision and sensitivity. A theoretical discussion of the method and its applications for industrial use is followed by descriptions of experiments with different types of steel. Results show that good resolution of energy at the semiconductor detectors allows for the rapid acquisition of X-ray diffraction diagrams at a fixed angle of polychromatic radiation. So as to optimize this effect, the appropriate radiation spectrum must be used along with an adequate experimental setup (principally, the correct diffraction angle) as dictated by the type of material being examined and the expected level of residual austenite. Author (ESA)

N79-29312# Centre Technique des Industries Mecaniques, St. Denis (France).

TESTING FOR COLD FORGING SUITABILITY Final Report [TEST DE FORGEABILITE EN FORGE A FROID]

J. Penel and P. Ravassard Jul. 1978 52 p refs In FRENCH

(CETIM-1-3L-08-0) Avail: NTIS HC A04/MF A01

A test program for cold forgeability was established in order to determine the cold working characteristics of various types of steel. This test program was analyzed. The test methodology as well as test specimen handling techniques were considered. The accuracy of results and sensitivity to variations in metallic and mechanical parameters were evaluated, respectively. Test results were compared to results obtained under industrial conditions. References and test specifications are given and are intended for general distribution to future users. Author (ESA)

N79-29313# Centre de Recherches Scientifiques et Techniques de l'Industrie des Fabrications Metalliques, Brussels (Belgium). Sect. Construction Metallique.

INFLUENCE OF CRACK LENGTH ON HIGH STRENGTH STEELS LOADED BEYOND GENERAL YIELD

Ir. Rudy Denys and Ir. William Provost May 1978 34 p refs Sponsored by Inst. de Rech. Sci. pour l'Ind. et l'Agr.

(CRIF-MT-125) Avail: NTIS HC A03/MF A01

The general yield criterion for acceptability of defects which was originally established for mild steel, was applied to two high strength steels. These steels, having a higher yield strength/tensile strength ratio R, permitted a detailled examination of the influence of the workhardening capacity on the critical cracklength. Theoretical considerations, showing that higher R values should result in smaller critical cracklengths, were fully confirmed by the results. The application of the general yield criterion illustrates clearly that significantly lower values of critical defect sizes are determined for the high strength steels, compared to those obtained for lower strength steels. Author (ESA)

N79-29314# Bureau of Mines, Reno, Nev. Metallurgy Research Center.

ELECTROWINNING ZINC FROM ZINC CHLORIDE-ALKALI METAL CHLORIDE ELECTROLYTES

D. E. Shanks, F. P. Haver, C. H. Elges, and M. M. Wong 1979 23 p refs

(PB-293284/6; BM-RI-8343) Avail: NTIS HC A02/MF A01 CSCL 11F

The properties of ZnCl2-alkali metal chloride electrolyte systems in relation to the production of zinc metal are examined and electrolysis in largescale, internally heated cells is discussed. The effect of composition on bath stability, current efficiency, cell voltage, and liquidus temperature was determined for the

ZnCl2-NaCl-KCl, ZnCl2-NaCl-LiCl, and ZnCl2-KCl-LiCl electrolyte systems. An electrolyte composed of 38 mole-pct ZnCl2, 31 mole-pct NaCl, and 31 mole-pct KCl gave the best overall results. Sludge (ZnO) formation in the ZnCl2-NaCl-KCl, ZnCl2-KCl-LiCl, and ZnCl2-KCl systems was investigated during prolonged electrolysis. The ZnCl2-KCl-NaCl electrolyte showed the least sludge formation. A 1,500-amp cell was operated using the ZnCl2-NaCl-KCl electrolyte at 500C. Zinc metal was produced at the rate of 4.0 lb/hr with a current efficiency of 95 pct. GRA

27 NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

N79-29315 British Library Lending Div., Boston Spa (England).
A COMPARATIVE INVESTIGATION OF FLAME RETARDANTS
A. Hopp, H.-P. Skilandat, Barbara Taubert, and I. Klotzscher Jul. 1978 27 p refs Transl. into ENGLISH from Plaste Kaut. (East Germany), v. 23, no. 3, 1976 p 192-197
(BLL-RAE-Trans-1974-(5207); RAE-Lib-Trans-1974) Avail: British Library Lending Div., Boston Spa, Engl.

Research on various plastics to determine their flame retardant characteristics is presented. The classification of phosphate plasticisers according to their flame-resistant properties always followed the order: tris-(halogen-alkyl-)phosphate; triarylphosphate; trialkylphosphate. In the case of inorganic flame retardants, it was possible to show that, in general, 50 percent of the antimony trioxide used can be replaced by borate without any decrease in the flame resistance, whereupon the different effects on the thermal stability of PVC when Ba and Zn borate are used reveal a certain action on the flame retardant properties. M.M.M.

N79-29316 Florida State Univ., Tallahassee.
THERMODYNAMIC AND MORPHOLOGICAL PROPERTIES OF BULK AND SOLUTION CRYSTALLIZED ETHYLENE BUTENE-1 COPOLYMER FRACTIONS Ph.D. Thesis
Roberto S. Benson 1978 175 p
Avail: Univ. Microfilms Order No. 7917016

For the bulk crystallized, the supermolecular structure observed for the ethylene butene-1 (EBC) fractions varied with the co-unit concentrations and the molecular weight. The uniformity of the crystal decreased with co-unit content. Large over-growths were seen for fractions with ethyl concentrations greater than 2.00 mole %. The changes in the morphology for the melt crystallized samples showed a strong dependence on the degree of crystallinity. The differences between the crystallinities calculated from density and enthalpy of fusion showed changes which can be associated with variation in the supermolecular structure. Dissert. Abstr.

N79-29317 Michigan Univ., Ann Arbor.
INELASTIC SCATTERING FROM POLYMER SOLUTIONS Ph.D. Thesis
Mastapha Benmouna 1979 201 p
Avail: Univ. Microfilms Order No. 7916666

A theoretical method for the interpretation of coherent inelastic scattering experiments from polymer solutions is proposed. The basic quantity in the analysis is the normalized intermediate scattering function S(q,t), which is measured in the experiments. The approach is based on linear response theory, which yields a general expression for S(q,t) in terms of the dynamical operator, and the equilibrium distribution. The case of scattering from a single labelled chain was studied as well as the scattering from all identical chains. Dissert. Abstr.

N79-29318 Akron Univ., Ohio.
TERPOLYMERIZATION OF DONOR MONOMERS AND ACCEPTOR MONOMERS IN THE PRESENCE OF MONOMER COMPLEXING AGENTS Ph.D. Thesis
Jing-Shing Shu 1979 149 p
Avail: Univ. Microfilms Order No. 7918776

Three terpolymerization systems, all containing an electron-donor monomer, two electron-acceptor monomers and an alkylaluminum halide were investigated. The mole fraction of donor monomer (styrene) is always equal to the sum of acceptor monomers in terpolymerizations prepared over a wide range of monomer charge ratios. It was concluded that the products obtained are true terpolymers and the terpolymerization follows a conventional free radical mechanism. The relative reactivities and the relative potential barriers of the free and complexed monomers toward the styryl radical are estimated. Dissert. Abstr.

N79-29319 Michigan Univ., Ann Arbor.
SMALL-ANGLE NEUTRON SCATTERING FROM POLYMERS MEASURED BY THE TRIPLE-CRYSTAL REFLECTION METHOD Ph.D. Thesis
Wei-Hsiang Teng 1979 212 p
Avail: Univ. Microfilms Order No. 7916828

The potential of using a high resolution triple-crystal spectrometer for the study of small-angle neutron scattering (SANS) was investigated with the following samples: (1) polystyrene in deutero-cyclohexane at 41 C, and (2) 4 Dow Chemical uniform polystyrene latexes. Several SANS experiments on polyethylene (PE) are also presented; one experiment was performed to determine the concentration fluctuation of PED in the PED-PEH mixture. Despite the low source intensity, this high resolution spectrometer is especially useful for those samples whose SANS intensities are rather strong, but the widths of the scattering functions can not be resolved by other relatively low resolution spectrometers. Dissert. Abstr.

N79-29320 Delaware Univ., Newark.
PREPARATION AND CHARACTERIZATION OF POLYMER-BOUND TETRAIRIDIUM CLUSTER CATALYSTS FOR OLEFIN HYDROGENATION Ph.D. Thesis
Joseph Lieto 1979 190 p
Avail: Univ. Microfilms Order No. 7918215

The clusters of tetrairidium carbonyls bonded to phosphine groups on poly(styrene-divinylbenzene) were studied. The metal species were identified by infrared spectroscopy by comparison of their carbonyl spectra to those of known molecular clusters. The rate of olefin hydrogenation decreased with an increasing number of phosphine substituents on the cluster. It was concluded that the metal clusters themselves participated in the catalytic cycle, with a mechanism of generation of coordinatively unsaturated sites involving reversible cleavage of Ir-Ir bonds or Ir-P bonds. Dissert. Abstr.

N79-29321 Washington Univ., Seattle.
ADHESIVE FORMULATION VIA THERMOLYTIC MODIFICATION OF LIGNIN Ph.D. Thesis
Norman Charles Foster 1979 191 p
Avail: Univ. Microfilms Order No. 7917568

The modification of lignin sulfonates for wood adhesive use was theoretically and experimentally investigated. The high temperature phenolysis of spray dried spent sulfinte pulping liquor was shown to provide the necessary lignin modifications. Resole resins formulated with phenolated lignins had gel cure times similar to those of a phenol-formaldehyde resin. Phenolated lignin resins formed wood bonds equivalent to those formed by straight phenolic resins. Wood glues formulated with phenolated lignins and ground Douglas Fir bark or walnut shell flour extenders formed water-proof polywood bonds. When plywood panels fabricated from these glue formulations were sheared, they did not achieve a sufficiently high level of wood failure (as opposed to shear failure in the glue line) to pass the exterior grade plywood test. Dissert. Abstr.

N79-29322 Delaware Univ., Newark.
STRUCTURE-PROPERTY RELATIONSHIPS OF SOLID POLYMERIC CATALYSTS: ISOPROPANOL DEHYDRATION CATALYZED BY SULFONATED POLYETHYLENE-GRAFTED STYRENE Ph.D. Thesis
Cawas Adarji Cooper 1979 255 p
Avail: Univ. Microfilms Order No. 7918802

The isopropanol dehydration reaction to give propylene was used as a measure of the effects of structural changes on the catalytic activity of semicrystalline polyethylene membranes containing grafted, sulfonated styrene. Structural changes in the

polymer catalyst were induced by constant-rate cold drawing of the membranes. Samples were drawn by 75 percent, 150 percent, and 200 percent of their initial lengths. Also, a multiple drawn sample was examined. The favorable arrangement of the -SO3H groups in 150 percent drawn catalyst corresponds to the optimum in catalytic activity. Separation of the catalytic sites beyond the hydrogen bonding distance in the samples drawn more than 150 percent was responsible for the lower values of the observed rates. Dissert. Abstr.

N79-29323 California Univ., Los Angeles.
THE PREPARATION AND ELECTROLYTIC PROPERTIES OF FLUOROBERYLLATE GLASSES Ph.D. Thesis
Chandler Milnes Baldwin 1979 261 p
Avail: Univ. Microfilms Order No. 7915647

An experimental technique was devised for directly identifying the electrolytic transport species in these highly resistive fluoroberyllate glasses. The technique monitors the Faradaic response of the electrolyzed glass with blocking and/or nonblocking electrodes. Both liquid and/or glass electrodes were utilized. The only conditions under which a nonpolarized Faradaic response could be maintained was when a fluorine source was present at the anode. It was concluded that the fluorine ion fully accounts for electrolytic transport in all fluoroberyllate glasses studied. Dissert. Abstr.

N79-29324 Princeton Univ., N. J.
STRUCTURE-PROPERTY RELATIONSHIPS IN SOLID POLYMERS. 1: SEGMENTED POLYURETHANES AND 2: EPOXY THERMOSETS Ph.D. Thesis
Zohar Hoffmann Ophir 1979 215 p
Avail: Univ. Microfilms Order No. 7918565

The domains' morphology and thermal stability of segmented polyurethanes and the physical aging of epoxy thermosets are investigated. The physical aging process of the epoxy thermosets was studied by stress relaxation, DSC, thermal expansion, Izod impact, solvent absorption and SEM. The information obtained from these experiments was used to rationalize the loss of peel strength of epoxy adhesives during sub-Tg annealing. The contribution of the present studies to the understanding of structure-property relationships in these systems as well as their implications for further research are discussed. Dissert. Abstr.

N79-29325 Michigan Univ., Ann Arbor.
STRUCTURE ANALYSIS OF AMORPHOUS POLYMERS BY DIFFERENTIAL RADIAL DISTRIBUTION FUNCTIONS Ph.D. Thesis
Mani Ram Gupta 1979 207 p
Avail: Univ. Microfilms Order No. 7916714

A detailed structural analysis was performed on three polyethylene terephthalate (PET) and three irradiated polyethylene (PE) samples using wind angle X-ray scattering (WAXS). The WAXS data were transformed into differential radial distribution function ($D_N DF$) curves using a computer program. The DRDFs of all three PET samples were similar. The experimental DRDFs of the irradiated PE samples were analyzed by fitting theoretical DRDFs from application of paracrystalline lattice theory to a distorted hexagonal lattice. The closeness of the fit between the experimental and theoretical DRDFs suggests that a distorted hexagonal lattice is present in the irradiated PE samples. Dissert. Abstr.

N79-29326 Michigan Univ., Ann Arbor.
THE PARAMETERS AFFECTING THE ENTHALPY AND THE TEMPERATURE DEPENDENCE OF THE ENTHALPY OF GLASSY ATACTIC POLYSTYRENE Ph.D. Thesis
Joseph Chester Golba, Jr. 1979 295 p
Avail: Univ. Microfilms Order No. 7916710

Enthalpies of atactic polystyrene glasses, relative to the amorphous liquid state, were determined from heat of solution measurements using a Tian-Calvet type isothermal differential microcalorimeter. The enthalpies of glasses formed by cooling an intially molten polymer through the glass transition at various rates were observed to decrease linearly with the logarithm of the cooling rate. From the birefringence of hot drawn glasses a molecular deformation resembling that of the affine deformation model may be inferred. At intermediate degrees of molecular orientation as isoenthalpic state was realized. The behavior of the enthalpy with respect to the density was observed to be different for glasses formed at ambient pressure, for glasses formed at elevated pressures and for solution cast glasses. Specific heat curves of the glasses studied were obtained. Dissert. Abstr.

N79-29327*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PLASMA-SPRAYED COATINGS FOR LUBRICATION OF A TITANIUM ALLOY IN AIR AT 430 deg C
Harold E. Sliney and Donald H. Wisander Jul. 1979 14 p
(NASA-TP-1509; E-9876) Avail: NTIS HC A02/MF A01 CSCL 11H

Plasma sprayed coatings of pure silver and of composite materials containing silver were investigated as possible self lubricating coatings for titanium alloys in air at 430 C. Pure silver provided low friction but was prone to severe plastic deformation and excessive transfer except in coating thicknesses of 0.02 mm or less. Additions of nichrome, calcium fluoride, and glass to silver were all beneficial in reducing plastic deformation and otherwise improving the coatings. The longest coating wear life, low wear of Ti alloy pins in sliding contact with the coatings, and a steady friction coefficient of 0.19 were obtained with a four component coating of 0.17 mm thickness. The coating composition, in weight percent is 30 nichrome-30 Ag-25 CaF2-15 glass. Author

N79-29328# Royal Aircraft Establishment, Farnborough (England).
ENVIRONMENTAL EFFECTS ON THE ELASTIC-PLASTIC PROPERTIES OF ADHESIVES IN BOND METAL JOINTS
Walter Althof, Gerhard Klinger, Gerhard Neumann, and Johanna Schlothauer Jan. 1979 97 p refs Transl. into ENGLISH "Klimaeinfluss auf die Kennwerte des Elasto-Plastischen Verhaltens von Klebstoffen in Metallklebungen" Report DLR-FB-77-63 DFVLR, Brunswick, 1977
(RAE-Lib-Trans-1999; BR67977) Avail: NTIS HC A05/MF A01

The shear modulus, the stress at 1% shear strain, the shear strength, the strain at fracture and the appertaining shear stress-strain diagrams are analyzed for ten aircraft structural adhesives. These values are calculated from the measured load-deflection behavior of the adhesives in the bond line of lap joints with a thick adherend and a small overlap length, as well as from the torsion pendulum testing of cast adhesives. The measurements are made before and after a long exposure to warmth, cold, moisture, warmth combined with moisture, and changes between cold and combined warmth and moisture. The environmental effects on the adhesion between adherend and adhesives as observed in the tests are described. Author

N79-29329*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
INFRARED ANALYSIS OF POLYETHYLENE WEAR SPECIMENS USING ATTENUATED TOTAL REFLECTION SPECTROSCOPY
William R. Jones and James L. Lauer (Rensselaer Polytech. Inst.) Jul. 1979 12 p refs
(NASA-TM-79228; E-130) Avail: NTIS HC A02/MF A01 CSCL 07D

Attenuated total reflection infrared spectroscopy was used to analyze ultrahigh molecular weight polyethylene wear test specimens. Three different specimens were analyzed. One specimen was gamma irradiated to a dose of 5.0 MRad, another to a dose of 2.5 MRad, and the final specimen was unirradiated. There was no conclusive evidence of chemical changes (i.e., unsaturation or oxidation) in the surface regions of any of the polyethylene samples. Therefore, it was concluded that the gamma irradiation sterilization procedure shoud not alter the boundary lubricating properties of the polyethylene. Author

N79-29330*# Bjorksten Research Labs., Inc., Madison, Wis.
THE UPGRADING OF GLASS MICROBALLOONS Final Report
Stanley A. Dunn and Steven Gunter 1979 47 p refs
(Contract NAS8-33101)
(NASA-CR-161280) Avail: NTIS HC A03/MF A01 CSCL 11B

The processes and mechanisms involved in producing glass

microballoons of acceptable quality for laser fusion by gas jet levitation and manipulation were studied. Glass microballoons (GMBs) levitated at temperatures below, as well as above the liquidus, appear to diffuse sulfur dioxide, a polar molecule with a moderately large diameter, and hydrogen, a much smaller molecule at comparable rates. Rates on the order of tens of atmospheres per hour (constant volume) per atmosphere of partial pressure differential have been observed at temperatures around the liquidus. Relatively rapid and convenient filling of molten GMBs by levitation in deuterium and tritium appears to be a possibility. J.M.S.

N79-29331*# United Technologies Research Center, East Hartford, Conn.

NEW HIGH TEMPERATURE CROSS LINKING MONOMERS

Daniel A. Scola 20 Dec. 1978 115 p refs

(Contract NAS3-21009)

(NASA-CR-159514; UTRC/R78-912897-15) Avail: NTIS HC A06/MF A01 CSCL 07C

Several PMR-polyimide resins capable of being processed at a maximum temperature of 232 C to 288 C without sacrifice of high temperature capability were developed. Four monomethyl esters were synthesized and characterized for use in the crosslinking studies. The infrared and DSC studies of each crosslinker suggested that curing could be accomplished at 288 C. However, fabrication of dense, void free polymer specimens required a temperature of 316 C and a pressure of 0.69 MPa (100 psi). Crosslinkers were evaluated in Celion 6000/PMR polyimide composites. These composites were characterized at RT, 288 C and 316 C initially and after isothermal aging at 288 C and 316 C for several hundred hours. The results suggest that both PMR systems are promising candidates as matrices for addition type polyimide composites. It is demonstrated that alternate crosslinkers are feasible, but mechanisms to lower the crosslinking temperature must be developed to provide lower temperature processing PMR-type polyimides. K.L.

N79-29332*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

ENVIRONMENTAL EFFECTS ON SPACE SHUTTLE REUSABLE SURFACE INSULATION COATED WITH REACTION CURED GLASS

Philip O. Ransone, J. D. Morrison, and John E. Minster Aug. 1979 23 p refs Prepared in cooperation with NASA. Kennedy Space Center, Cocoa Beach, Fla.

(NASA-TM-80071; L-12962) Avail: NTIS HC A02/MF A01 CSCL 11B

Sample titles of the space shuttle reusable surface insulation was subjected alternately to simulated mission heating and either real or simulated environmental exposure for up to 34 cycles. The coating cracked as a result of exposure to high temperature and moisture conditions, and insulation with cracked coatings absorbed significant quantities of water in the launch-pad environment. Cracking was a complex function of time, temperature, and moisture exposure. Cracked coatings remained adherent to the insulation for up to 24 cycles past initial cracking. M.M.M.

N79-29333*# McDonnell-Douglas Astronautics Co., St. Louis, Mo.

DEVELOPMENT, FABRICATION AND TEST OF A HIGH PURITY SILICA HEAT SHIELD Final Report

E. L. Rusert, D. N. Drennan, and M. S. Biggs Apr. 1978 120 p refs

(Contract NAS2-8895)

(NASA-CR-152117) Avail: NTIS HC A06/MF A01 CSCL 07D

A highly reflective hyperpure (< 25 ppm ion impurities) slip cast fused silica heat shield material developed for planetary entry probes was successfully scaled up. Process development activities for slip casting large parts included green strength improvements, casting slip preparation, aggregate casting, strength, reflectance, and subscale fabrication. Successful fabrication of a one-half scale Saturn probe (shape and size) heat shield was accomplished while maintaining the silica high purity and reflectance through the scale-up process. However, stress analysis of this original aggregate slip cast material indicated a small margin of safety (MS. = +4%) using a factor of safety of 1.25. An alternate hyperpure material formulation to increase the strength and toughness for a greater safety margin was evaluated. The alternate material incorporates short hyperpure silica fibers into the casting slip. The best formulation evaluated has a 50% by weight fiber addition resulting in an 80% increase in flexural strength and a 170% increase in toughness over the original aggregate slip cast materials with comparable reflectance. A.W.H.

N79-29334# Durham Univ. (England).

STEP-GROWTH PHOTOPOLYMERIZATIONS Final Technical Report, Jul. 1975 - Jan. 1979

W. J. Feast Jan. 1979 145 p refs

(Grant DA-ERO-75-G-034; DA Proj. 1T1-61102-B-13B-00)

(AD-A068384) Avail: NTIS HC A07/MF A01 CSCL 07/3

This report is divided into two parts. The first part describes an attempt to extend earlier work on step-growth photopolymerization leading to polyoxetanes to the synthesis of fluorinated polyoxetanes. This work, which was the primary objective of the research, was unfruitful. A variety of olefin and carbonyl containing monomers were prepared but all polymerization attempts failed. The second part of the report describes work undertaken in response to the difficulties encountered with the initial project, several topics involving the use of aromatic carbonyl compounds as components of potential step-growth photoreductive photopolymerizations were investigated. Some work was carried out on photoreductive polymerization leading to polypinacols, and the possibility of extending this approach to the synthesis of polymers with pentaphenylglycerol or tetraphenylethanol repeat units was also examined. This work led to the synthesis of some novel polymers and provided information on the limitations of some photochemical reactions. GRA

N79-29335# Air Force Materials Lab., Wright-Patterson AFB, Ohio.

SYNTHESIS AND PROPERTIES OF RODLIKE AROMATIC HETEROCYCLIC POLYMERS: PHENYLATED PARA-TERPHENYLENE-POLYBENZOBIS-OXAZOLES Final Technical Report, Apr. 1976 - Jan. 1978

J. F. Wolfe and F. E. Arnold Dec. 1978 29 p refs

(AF Proj. 2303)

(AD-A068253; AFML-TR-78-197) Avail: NTIS HC A03/MF A01 CSCL 11/9

One of the goals of current synthetic polymer research is to prepare high-modulus, high-strength structural materials for aerospace applications. The successful polymer system must: (1) Have a molecular structure that imparts unusually high tensile strength and modulus; (2) Be amenable to fabrication by a method that maximizes these properties; (3) Possess a high use-temperature; (4) Result in moisture-insensitive and hydrolytically stable fabricated parts. GRA

N79-29336# Rockwell International Science Center, Thousand Oaks, Calif.

IMPACT DAMAGE THRESHOLDS IN BRITTLE MATERIALS IMPACTED BY WATER DROPS Final Report, 1 Mar. 1975 - 31 Dec. 1978

A. G. Evans, Y. M. Ito, and M. Rosenblatt Mar. 1979 40 p refs

(Contract N00014-75-C-0669)

(AD-A068440; SC5023.11FR) Avail: NTIS HC A03/MF A01 CSCL 11/2

The damage threshold for brittle materials impacted by water drops has been studied by using a combination of analytic and numerical approaches to obtain solutions for the impact stress fields and dynamic stress intensity factors. It has been shown that expressions for the damage threshold, which consists of the activation of pre-existent surface microcracks, can be derived from these solutions. The expressions identify three types of behavior, depending upon the adjacence of the pre-existent cracks to the impact center, vis-a-vis their size, and describe the respective roles of the three important target parameters, the fracture toughness, the elastic wave velocity and the pre-existent flow size. An absolute damage threshold has also been defined. The

conditions at this threshold are demonstrated to be reasonably consistent with available threshold measurements. GRA

N79-29337# Ceramic Finishing Co., State College, Pa.
LOCALIZED IMPACT DAMAGE IN CERAMICS. THEORY OF ELASTIC-PLASTIC IMPACT ON CERAMICS. LOCALIZED IMPACT DAMAGE IN TRANSFORMATION TOUGHENED ZIRCONIA. CRACK PROPAGATION AND BRANCHING IN TRANSFORMATION TOUGHENED ZIRCONIA Technical Report, 1 Feb. 1978 - 31 Jan. 1979
H. P. Kirchner, D. M. Richard, R. C. Garvie (CSIRO, Melbourne, Australia), and R. M. Gruver Jan. 1979 109 p refs
(Contract N00014-74-C-0241)
(AD-A068972; TR-7) Avail: NTIS HC A06/MF A01 CSCL 11/2

The following are covered in this report: (1) Theory of elastic-plastic impact on ceramics; (2) Localized impact damage in transformation toughened zirconia; (3) Crack propagation and branching in transformation toughened zirconia. GRA

N79-29338# Ultrasystems, Inc., Irvine, Calif.
SYNTHESES OF PHOSPHATRIAZINES FOR POTENTIAL HIGH TEMPERATURE FLUIDS APPLICATIONS Final Report, 1 Mar. 1976 - 28 Feb. 1979
K. L. Paciorek, J. Kaufman, J. H. Nakahara, T. I. Ito, and R. H. Kratzer 30 Apr. 1979 36 p refs
(Contract F44620-76-C-0065)
(AD-A068999; SN-8296/F; AFOSR-79-0608TR) Avail: NTIS HC A03/MF A01 CSCL 13/8

A series of six and eight membered heterocycles containing phosphorus, carbon and nitrogen atoms in the ring were synthesized. The specific classes of compounds prepared were monophospha-s-triazines, diphospha-s-triazines,:dumbbell: phospha-s-triazines, and diphosphatetraazacyclooctatetraenes. The presence of perfluoroalkylether side chains on the carbon ring atoms rendered the resulting compounds liquids at room temperature; substitution by perfluoroalkyl groups led to solids. Both the mono and diphospha-s-triazines were found to be effective anti-corrosion additives for perfluoroalkylether type fluids. Author (GRA)

N79-29339# Northwestern Univ., Evanston, Ill. Dept. of Materials Science.
AN IMAGE INTENSIFIER FOR ELECTRON MICROSCOPY OF POLYMERS
P. Bratt, W. R. Even, and S. H. Carr 16 Apr. 1979 20 p refs
(Contract N00014-75-C-0963)
(AD-A069002; TR-6) Avail: NTIS HC A02/MF A01 CSCL 11/9

A unique manipulator for a channel electron multiplier array (CEMA) has been designed and constructed. It allows for easy installation into the viewing chamber of a transmission electron microscope. This device, through a series of motions, positions the CEMA normal to the electron beam, thus amplifying the electron flux while preserving its image. This increase in image brightness permits operation of the microscope with a greatly reduced flux of electrons passing through the sample, thereby decreasing radiation damage while simultaneously extending the time available for examination of the specimen. The manipulator can then move the CEMA to a remote area of the chamber, thus returning the microscope to its normal operating mode. GRA

N79-29340# Case Western Reserve Univ., Cleveland, Ohio. Dept. of Macromolecular Science.
CRAZE INITIATION CRITERION IN GLASSY POLYMERS UNDER HIGH PRESSURE Interim Technical Report
Abdelsamie Moet, Igor Palley, and Eric Baer 11 May 1979 20 p refs
(Contract N00014-75-C-0795)
(AD-A069116; TR-8) Avail: NTIS HC A02/MF A01 CSCL 11/9

The initiation of crazes in glassy polymers is accounted for by a single criterion according to which crazing occurs when the maximum stress at the tip of a flaw (sigma(max)) reaches a critical value. This criterion can explain the initiation of crazes in polymethylmethacrylate and polystyrene tested in tension under superposed hydrostatic pressure. A single value of sigma(max) for each of the two polymers has been calculated and found to be independent of the applied hydrostatic pressure whether or not the polymer was exposed to the pressure-transmitting fluid. Our analysis predicts that relatively small stress-concentrations suffice for craze initiation even under remote compressivve stress states (negative first stress invariant). The predicted stress concentrations are in reasonable agreement with experimentally determined values. GRA

N79-29341# Southwest Research Inst., San Antonio, Tex. Army Fluids and Lubricants Research Lab.
MILITARY ENGINE OILS AS HYDRAULIC/POWER TRANSMISSION FLUIDS IN ARMY COMMERCIAL CONSTRUCTION EQUIPMENT Interim Report, Aug. 1975 - Mar. 1979
H. W. Marbach, Jr., S. J. Lestz, and M. E. LePera Mar. 1979 52 p refs
(Contracts DAAG53-76-C-0003; DAAK70-78-C-0001; DA Proj. 1L7-62733-AH-20)
(AD-A068116; AFLRL-113) Avail: NTIS HC A04/MF A01 CSCL 11/8

In 1971, the Army adopted a policy of procuring commercial-type construction and other off-highway equipment, referred to as CCE. With this equipment comes the equipment builder's warranty which requires use of hydraulic power transmission fluid (HPTF) which meets his specification. The fact that many different equipment suppliers will ultimately furnish their products to the military under this arrangement leads to the possible proliferation of proprietary fluids in the government supply system. To counteract this possibility, and hopefully eliminate such proprietary fluids, MERADCOM/AFLRL undertook an extensive experimental program aimed at determining the feasibility of using existing government-stocked lubricants in CCE HPTF systems. Fourteen test oils were compared against the John Deere proprietary reference oil in laboratory bench, wet-brake, and full-scale wear tests. Lubricants included nine qualified Military Specification engine oils, three commercial automatic transmission fluids (ATF), and two commercial type tractor hydraulic fluids. The military specification automotive engine lubricants, namely MIL-L-2104C OE/HDO-10, MIL-L-46167 OEA, and MIL-L-46152 grade 10W-30 proved to be equal or better in regards to gear wear than the John Deere proprietary fluid. GRA

N79-29342# SKF Industries, Inc., King of Prussia, Pa. Technology Services Div.
RESEARCH REPORT ON PERFORMANCE OF AUTOMOTIVE WHEEL BEARING GREASES Final Report, Mar. 1977 - Oct. 1978
N. J. Ninos, F. R. Morrison, J. I. McCool, and J. Rumierz Oct. 1978 126 p refs
(Contract DAAK70-77-C-0034)
(AD-A068829; SKF-AL78T022) Avail: NTIS HC A07/MF A01 CSCL 11/8

The objective of this program is to establish the relative performance characteristics of six greases in a simulated automotive front wheel tapered roller bearing environment under highly accelerated laboratory type test conditions. Part I deals with the evaluation of the test greases in a test machine designed to simulate the general configuration of an automotive front wheel bearing hub. Part II included a more detailed study of representative bearings to define the degree of deterioration experienced on the rolling contact surfaces of the bearings lubricated with each grease. Photomicrographs made with a Scanning Electron Microscope show the changes to the surface morphology of the cone rolling contact surfaces. Part III presents information on the changes occurring to the grease chemistry and structure from use in an elevated temperature bearing environment. GRA

N79-29343# Cornell Univ., Ithaca, N. Y. Dept. of Materials Science and Engineering.
EVIDENCE FOR IDEAL ELASTIC PLASTIC DEFORMATION IN Fe-Ni BASED METALLIC GLASSES Technical Progress Report
D. G. Ast and D. J. Krenitsky May 1979 18 p refs
(Contract N00014-77-C-0546)
(AD-A069119; TR-4) Avail: NTIS HC A02/MF A01 CSCL 11/2

It is shown that metallic glasses are ideal elastic plastic solids up to strains of about 7.5%. Yield stress variations of 20% from batch to batch are most likely caused by variation in the processing. GRA

N79-29344# Foxboro Co., Burlington, Mass. Analytical Div.
WEAR PARTICLE ANALYSIS OF GREASE SAMPLES
E. Roderic Bowen and John P. Bowen 18 Apr. 1979 86 p refs
(Contract N68335-76-C-2281)
(AD-A069114; NAEC-92-129) Avail: NTIS HC A05/MF A01 CSCL 11/8

An investigation was conducted to analyze a number of widely used types of grease samples by Ferrography. Solvent systems were successfully formulated to dissolve these greases for analytical purposes. A number of grease samples from aircraft components were subjected to Ferrographic analysis and results reported. GRA

N79-29345# General Electric Co., Schenectady, N. Y. Chemical Lab.
SILICONE BLOCK POLYMERS. 1: BPF CARBONATE-SILICONE BLOCK POLYMERS: PRODUCTION OF OPTICAL GRADE EXTRUDATES. 2: FLAMMABILITY OF SILICONE BLOCK POLYMERS Final Report, 26 Apr. 1977 - 26 Jul. 1978
R. P. Kambour, H. J. Klopfer, C. M. Orlando, and S. A. Smith Jan. 1979 114 p refs
(Contract N00019-77-C-0311)
(AD-A068639; SRD-79-033-1) Avail: NTIS HC A06/MF A01 CSCL 11/9

This report summarizes the results of two efforts dealing with silicone block polymers. The object of the first effort was to produce colorless transparent extrudates of bisphenol fluorenone carbonate-dimethylsiloxane (BPFC/DMS) block polymer elastoplastics suitable for use in aircraft transparencies. The objects of the second effort were to assess the extent to which silicone incorporation can enhance the flame resistance of organic polymers generally and to develop a better understanding of the mechanism of the enhancement already known to exist in polycarbonate-silicone block polymers. GRA

N79-29346# Foxboro Co., Burlington, Mass. Analytical Div.
ADVANCES IN WEAR PARTICLE ANALYSIS Final Report
Daniel P. Anderson, E. Roderic Bowen, and John P. Bowen 16 Feb. 1979 189 p refs
(Contract N00014-74-C-0135)
(AD-A068233; ONR-CR-69-007-1F) Avail: NTIS HC A09/MF A01 CSCL 14/2

Nine areas of investigation are described to improve wear particle analysis for machine condition monitoring through oil analysis. The nine areas are: (1) Use of temper colors to identify wear particles on ferrograms; (2) Quantimet analysis applied to ferrograms; (3) Calibration of the direct reading ferrograph; (4) Particle concentration equilibrium in lubricating oil; (5) Study of an oil sampling filter; (6) Support to applications of the delamination theory of wear; (7) Application of ferrography to hydraulic fluids; (8) A more quantitative ferrogram analysis sheet; and (9) Support to The Technical Cooperation Program.
Author (GRA)

N79-29347# Case Western Reserve Univ., Cleveland, Ohio. Dept. of Macromolecular Science.
CHARACTERIZATION OF POLYVINYLIDENE FLUORIDE Final Report, Jan. 1975 - Nov. 1978
M. H. Litt, J. B. Lando, J. Scheinbeim, and J. M. Bates Mar. 1979 36 p refs
(Grant DAAG29-75-G-0083)
(AD-A068197; ARO-12659.2-C) Avail: NTIS HC A03/MF A01 CSCL 11/9

An apparatus for measuring the electrical properties of polymer films is described. The dielectric and pyroelectric properties of commercial and radiation polymerized polyvinylidene fluoride are compared. GRA

N79-29348# Sandia Labs., Albuquerque, N. Mex.
RESPONSE OF FERROELECTRIC CERAMICS TO UNIAXIAL STRESS
I. J. Fritz 1979 9 p refs Presented at 10th US/UK Symp. on Neutron Generators, Albuquerque, N. Mex., 12 May 1979
(Contract EY-76-C-04-2170)
(SAND-79-0610C; Conf-790518-2) Avail: NTIS HC A02/MF A01

Changes in electrical polarization of ferroelectric ceramics subjected to non-hydrostatic stress can be caused by rotation of ferroelectric domains, or, in the case of materials near ferroelectric to antiferroelectric phase boundaries, by a stress-induced phase transformation. Both processes were observed in mechanical measurements on PZT 95/5. The results may have important implications for the operation of shock-actuated ferroelectric power supplies. DOE

N79-29349# Sandia Labs., Albuquerque, N. Mex.
GLASS-CERAMICS FOR SEALING TO Pd-Ag ALLOYS
C. J. Leedecke and H. K. Baca Mar. 1979 27 p refs
(Contract EY-76-C-04-0789)
(SAND-79-0248) Avail: NTIS HC A03/MF A01

The development of glass ceramics based on the K2O-Li2O-B2O3-SiO2 and Li2O-ZnO-SiO2 systems and a process for sealing Pd-Ag alloy pins in a stainless steel body is described. To fabricate hermetic seals it is necessary to control both the thermal expansion of the glass ceramic and the sealing atmosphere. The thermal expansion of the glass ceramic must approximately match that of the pins. An oxidizing atmosphere consisting of 60 percent N2 and 40 percent air is required to form surface oxides which promote wetting of the metal by the insulator. DOE

N79-29350# Los Alamos Scientific Lab., N. Mex.
EFFECTS OF IRRADIATION ON STRUCTURAL PROPERTIES OF CRYSTALLINE CERAMICS
F. W. Clinard, Jr. and G. F. Hurley 1979 16 p refs Presented at the Intern. Symp. on Ceram. in Nucl. Waste Management, Cincinnati, 30 Apr. 1979
(Contract W-7405-eng-36)
(LA-UR-79-824) Avail: NTIS HC A02/MF A01

The stability of crystalline ceramic nuclear waste may be degraded by self-irradiation damage. Changes in density, strength, thermal conductivity, and lattice structure are of concern. Structural damage of ceramics under various radiation conditions is discussed and related to possible effects in nuclear waste. DOE

N79-29351# California Univ., Livermore. Lawrence Livermore Lab.
EVALUATION OF STIFFNESS PROPERTIES FOR DIFFERENT MORPHOLOGIES IN POLYMER BLENDS AND COMPOSITES
R. M. Christensen 12 Oct. 1978 6 p refs Presented at 177th Am. Chem. Soc. Natl. Spring Meeting, Honolulu, 4-6 Apr. 1979
(Contract W-7405-eng-48)
(UCRL-81582; Conf-790415) Avail: NTIS HC A02/MF A01

The relative stiffening effects given by different morphological forms in two phase material combinations are reviewed. Specifically, three geometric forms are considered for one phase embedded in another continuous matrix phase: particulate, fibrous, and interpenetrating network. The interpenetrating phase case is treated by taking a distribution of randomly oriented lamella or platelets. The platelets are taken to have a very large diameter to-thickness ratio so that the edge effects can be neglected. The resulting stiffness properties are expressed in terms of the volume fraction of each phase and their bulk and shear moduli. The resulting effective stiffness formulas are unchanged under conditions of a phase inversion. This behavior is required for a material of interpenetrating networks in which there is no geometric feature of the interface that can be used to distinguish which material is on which side of the interface. DOE

28 PROPELLANTS AND FUELS

Includes rocket propellants, igniters, and oxidizers, storage and handling; and aircraft fuels.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *44 Energy Production and Conversion.*

N79-29352 British Library Lending Div., Boston Spa (England).
VAPOUR EXPLOSIONS PRODUCED BY CONTACT BETWEEN WATER AND HOT MELTS
Georg Froehlich Mar. 1979 19 p refs Transl. into ENGLISH from Chem.-Ing.-Tech. (West Ger.), v. 50, no. 11, 1978 p 861-866
(BLL-CTO-1589-(9091.9F)) Copyright. Avail: British Library Lending Div., Boston Spa, Engl.

Experimental results are discussed for water as the cooler liquid and melts of glass or metal (Ga, Pb, Al, Cu, Fe) as the hotter liquid. The probability of the occurrence of steam explosions depends on the material of the melt, the temperatures of the two liquids (not only their temperature difference), the reacting masses, the shape of the device in which the reaction is to occur, and external triggering. M.M.M.

N79-29353 Stanford Univ., Calif.
IN-SITU COMBUSTION MODELS FOR THE STEAM PLATEAU AND FOR FIELDWIDE OIL RECOVERY Ph.D. Thesis
Abdurrahman Satman 1979 124 p
Avail: Univ. Microfilms Order No. 7917278

The steam plateau region of laboratory combustion tube experiments was studied and heat transfer modes describing the steam plateau were defined. The combustion parameters affecting the steam plateau were also studied and evaluated. An analytical heat model was developed which describes the movement of the steam plateau axially along a cylinder with heat loss through an annular insulation. Correlations were developed to predict field scale recovery of dry in-situ combustion processes. After developing the correlations, their validity was tested. The match between the correlations and field test results was satisfactory. The study shows that the recovery correlations developed for dry combustion processes may be used for the recovery prediction of the wet combustion test in which the air-water injected ratio is high. Dissert. Abstr.

N79-29354*# California Univ., Los Angeles. School of Engineering and Applied Science.
FORECAST OF FUTURE AVIATION FUELS. PART 1: SCENARIOS Progress Report, 1 Aug. 1976 - 20 Sep. 1977
J. M. English, C. Y. Liu, J. L. Smith, A. K. K. Yin, G. A. Pan, M. B. Ayati, M. Gyamfi, and M. R. Arabzadah 17 Mar. 1978 140 p refs Revised
(Grant NsG-3116)
(NASA-CR-158871; UCLA-ENG-77-78-Pt-1) Avail: NTIS HC A07/MF A01 CSCL 21D

A preliminary set of scenarios is described for depicting the air transport industry as it grows and changes, up to the year 2025. This provides the background for predicting the needs for future aviation fuels to meet the requirements of the industry as new basic sources, such as oil shale and coal, which are utilized to supplement petroleum. Five scenarios are written to encompass a range of futures from a serious resource-constrained economy to a continuous and optimistic economic growth. A unique feature is the choice of one immediate range scenario which is based on a serious interruption of economic growth occasioned by an energy shortfall. This is presumed to occur due to lags in starting a synfuels program. Author

N79-29355*# Lockheed-California Co., Burbank.
EXPERIMENTAL STUDY OF LOW TEMPERATURE BEHAVIOR OF AVIATION TURBINE FUELS IN A WING TANK MODEL Final Report
Francis J. Stockemer 1979 112 p refs
(Contract NAS3-20814)
(NASA-CR-159615) Avail: NTIS HC A06/MF A01 CSCL 21D

An experimental investigation was performed to study aircraft fuels at low temperatures near the freezing point. The objective was an improved understanding of the flowability and pumpability of the fuels under conditions encoutered during cold weather flight of a long range commercial aircraft. The test tank simulated a section of an outer wing tank and was chilled on the upper and lower surfaces. Fuels included commercial Jet A and Diesel D-2; JP-5 from oil shale; and Jet A, intermediate freeze point, and D-2 fuels derived from selected paraffinic and naphthenic crudes. A pour point depressant was tested. M.M.M.

N79-29356# Committee on Commerce, Science, and Transportation (U. S. Senate).
LIQUEFIED ENERGY GASES, PART 2
Washington GPO 1978 388 p refs Hearings before the Comm. on Commerce, Sci., and Transportation, 95th Congr., 2d Sess., 12-13 Dec. 1978
(GPO-39-305) Avail: Comm. on Commerce, Sci., and Transportation

Problems related to the handling, transportation, and storage of liquefied natural gas and liquefied petroleum gases are discussed with emphasis on jurisdictional ambiguities, regulatory delays, preemption, accident control, liability, compensation, inspection, and enforcement efforts. Safety management and environment protection aspects are also considered. A.R.H.

N79-29357# Fluorochem, Inc., Azusa, Calif.
HIGH ENERGY HALOGEN CHEMISTRY Interim Summary Report, 1 Jan. 1978 - 28 Feb. 1979
Kurt Baum, Phillip T. Berkowitz, and Allen M. Guest Mar. 1979 35 p refs
(Contract N00014-78-C-0147)
(AD-A068398) Avail: NTIS HC A03/MF A01 CSCL 07/3

The objective of this program is to develop new synthetic methods for classes of compounds with potential utility in high energy propellant and explosives. Emphasis was continued on studies of the chemistry of 2-fluoro-2-nitro-1, 3-propanediol and related compounds, and on polymerization studies of nitrooxetanes and epoxides. A manuscript on Michael reactions of nitro compounds with methylenemalonates comprises Appendix A of this report. The products are potentially useful nitrooxetane intermediates. GRA

N79-29358# Ogden Air Logistics Center, Hill AFB, Utah. Propellant Lab. Section.
PROPELLANT SURVEILLANCE REPORT LGM-30 F AND G STAGE 1 PHASE E, SERIES 7 TP-H1011
John A. Thompson Apr. 1979 127 p
(AD-A069080; MANCP-416(79)) Avail: NTIS HC A07/MF A01 CSCL 21/9

This report contains propellant test results from cartons of TP-H1011 bulk propellant representing LGM-30 F and G First Stage Minuteman Motors. This report uses a statistical approach to analyze the bulk carton propellant data. Testing was accomplished in accordance with MMWRM Project M8293-4CWNL17514. The data from this test period are combined with data from previous testing and entered into the GO85 computer for storage, analysis and regression analysis. From the statistical analysis of all data tested to date (thirteen years for F and G), significant degradation of the propellant does not appear likely for at least two years past the oldest data point. Each point on the regression plot represents the mean of all samples at that particular age. The number of samples at each point is indicated on the sample size summary sheet on the page accompanying each regression plot which represents the mean of all samples at that particular age. The number of samples at each point is indicated on the sample size summary sheet on the page accompanying each regression plot or group of regression plots. The data range at any age can be found by suitable use of the G085 system. GRA

N79-29359# Exxon Research and Engineering Co., Linden, N. J. Government Research Lab.
CONTINUATION STUDY OF ALTERNATE FUELS NITROGEN CHEMISTRY Final Technical Report, 1 Feb. 1978 - 31 Jan. 1979
John W. Frankenfeld and William F. Taylor Feb. 1979 58 p refs
(Contract N00019-78-C-0177)

(AD-A069011; EXXON/GRU.2KWC.79) Avail: NTIS HC A04/MF A01 CSCL 21/4

An investigation of the effects of nitrogen compounds on sediment formation during fuel storage was carried out using model fuel systems. Various weak to non-basic nitrogen compounds, especially alkyl pyrroles and indoles were found to promote sediment formation; basic nitrogen compounds such as most amines did not. The sediment formation was strongly catalyzed by light and carboxylic acids. Phenols and aromatic thiols retard sedimentation. Sulfides and aliphatic thiols had little effect. Moisture and and traces of mineral acid also had little or no influence on sediment formation. The structure of the sediment was investigated using infrared and mass spectroscopy. GRA

N79-29360# Naval Weapons Station, Yorktown, Va.
EFFECT OF HNS ON PHYSICAL PROPERTIES OF TNT EXPLOSIVE: SURVEILLANCE EVALUATION
Winona C. Hogge Mar. 1979 78 p refs
(AD-A068483; NWSY-TR-79-1) Avail: NTIS HC A05/MF A01 CSCL 19/1

A laboratory scale study on the effects of small percentages of the anticracking explosive additive, 2,2',4,4',6,6' hexanitrostilbene (HNS), on the physical characteristics (i.e., cracking, density, exudation, crystal pattern, and dimensional growth) of small billets of TNT and TNT-based explosive compositions was conducted by subjecting them to an extended JAN temperature cycle of 6 to 21 months. An evaluation of the Swedish Bofors processing technique for the incorporation of HNS was included. The immediate improvement in the handling qualities of the billets was not significantly reflected in an improvement in long-term irreversible growth; in fact, growth resulted in crumbling with time. The Bofors two-stage method and the minimum of 30 minutes required to achieve maximum solubility at 100 C of the HNS in TNT resulted in increasing processing time by a considerable factor. The close temperature control, 83 to 86 C, remelt also is a disadvantage in a production process. GRA

N79-29361# Naval Surface Weapons Center, White Oak, Md.
SYNTHESIS OF ENERGETIC MATERIALS AT HIGH PRESSURES Annual Report, 1 Nov. 1977 - 31 Oct. 1978
William M. Koppes and Horst G. Adolph 21 Dec. 1978 30 p refs
(RR0240201)
(AD-A068484; NSWC/WOL/MP-78-22) Avail: NTIS HC A03/MF A01 CSCL 19/1

Fluorodinitroacetonitrile (FDAN) has been trimerized to the 1, 3, 5-triazine structure at 10 kbar pressure with the use of acidic alcohol catalysts. The pseudohalogen character of the CF(NO2)2 group, however, makes it subject to displacement from the triazing ring by the alcohol catalyst. As a result the major triazine products bear alkoxy substituents. In the case of CF3CH2OH as catalyst the chief triazine product is (CF3CH2O)2(CN3)CF(NO2)2. Reaction of preformed imidic ester with the nitrile can diminish this side reaction to the point where CF3CH2O(CN)3(CF(NO2)2)2) is the chief triazine product. There is evidence that the FDAN cylotrimer is formed in low yield with CF3CH2OH as catalyst but the compound has not been isolated. The use of the more acidic PhOH as catalyst gives PhO(CN)3 (CF(NO2)2)2 as the chief product but the tris (fluorodinitromethyl) triazine still remains as a minor product, if present at all. Two mechanisms of cyclotrimerization appear operative, depending on the structure of the imidic ester intermediate. GRA

N79-29362# Ballistic Research Labs., Aberdeen Proving Ground, Md.
A PRIORI ESTIMATION OF RATE CONSTANTS FOR UNIMOLECULAR DECOMPOSITION REACTIONS
George F. Adams Feb. 1979 34 p refs
(DA Proj. 1L1-61102-AH-60)
(AD-A069132; AD-E430223; ARBRL-TR-02143) Avail: NTIS HC A03/MF A01 CSCL 07/4

A priori theoretical predictions for the decomposition rate of the formyl and the methoxy radicals have been made by application of the Rice-Ramsperger-Kassel-Marcus Theory. An Arrhenius rate coefficient expression is derived for the formyl radial decomposition, and a modified Arrhenius type rate coefficient expression that includes pressure dependence is derived for the methoxyl radical decomposition. GRA

N79-29363# United Technologies Research Center, East Hartford, Conn.
ELECTROCHEMICAL TEST METHOD FOR EVALUATING LONG-TERM PROPELLANT-MATERIAL COMPATIBILITY Final Report, 1 Mar. 1977 - 30 Nov. 1978
C. T. Brown Dec. 1978 195 p refs
(Contract F04611-77-C-0020)
(AD-A068626; AFRPL-TR-78-80) Avail: NTIS HC A09/MF A01 CSCL 21/9

An electrochemical technique for evaluating the long-term compatibility of liquid propellants in various containment materials is described. The method requires that the liquid and containment material be electrical conductors, that the exchange current be measurable, and that the propellant decomposition mechanism be known. The time base is then altered by electrolysis of the system at some multiple of the natural decomposition rate. As a result, a simulated time scale is achieved in which the propellant decomposition rate can be predicted up to fifteen years while the actual time required for the tests is on the order of one to two months, depending on the particular metal tested. GRA

N79-29364# Monsanto Research Corp., Dayton, Ohio.
ANALYSIS OF THE EMISSIONS FROM STORAGE TANKS DURING JP-4 FUEL TRANSFER OPERATIONS. PHASE 1: WARM WEATHER CONDITIONS Final Report
W. R. Feairheller 1 May 1979 66 p refs
(Contract F41608-78-C-1240)
(AD-A069339) Avail: NTIS HC A04/MF A01 CSCL 21/4

This report summarizes the warm weather phase of a program to measure the concentration of JP-4 vapor that is emitted to the atmosphere during filling of underground storage tanks. Tests were conducted with and without pressure - vacuum breather valves. Samples were analyzed by a portable total hydrocarbon analyzer containing a flame ionization detector. Data was recorded at one minute intervals during the fuel transfer operations. All data was collected during August and September 1978 from 50,000 gallon underground JP-4 fuel storage tanks at Wright-Patterson AFB, OH. Author (GRA)

N79-29365# Sandia Labs., Albuquerque, N. Mex.
VISCOSITY REDUCTION OF COAL LIQUIDS BY DISSOLVED CARBON DIOXIDE
A. D. Yu and F. M. Orr, Jr. Mar. 1979 48 p refs
(Contract EY-76-C-04-0789)
(SAND-79-7027) Avail: NTIS HC A03/MF A01

The solubility of carbon dioxide in coal liquids and the viscosities of mixtures of coal liquids with CO2 were measured. Carbon dioxide in coal liquids was found to be comparable to its solubility in crude oils. It is sufficiently soluble to provide substantial viscosity reductions at concentrations below 10 weight percent. Significant precipitation of heavy hydrocarbon materials was observed during the viscosity measurements. DOE

N79-29366# Sandia Labs., Albuquerque, N. Mex.
COAL LIQUEFACTION CATALYST TAGS
D. G. Sample and M. G. Thomas Feb. 1979 28 p refs
(Contract EY-76-C-04-0789)
(SAND-79-0017) Avail: NTIS HC A03/MF A01

The identification and analysis of tagged catalysts from catalytic and liquefaction reactors that employ addition and withdrawal of catalysts can provide mixing characteristics and deactivation rates. Several methods for tagging coal liquefaction catalysts which were developed and evaluated include physical alternation, metals addition, and nuclear activation. Sputtering (vapor deposition) and painting (metal paints) are methods used for doping catalysts with metal tags which can be identified using radiographic techniques. Machining and filing catalysts, and altering extrusion dies can provide physical tags identified optically and by radiographic techniques. Neutron activation provides tags identified by a standard radiation counting method. The tags are evaluated on the bases of preparation, integrity, and detection. The use of the tags is considered for use in an H-Coal process demonstration unit. DOE

N79-29367# Gulf Research and Development Co., Pittsburgh, Pa.
INVESTIGATION OF MECHANISMS OF HYDROGEN TRANSFER IN COAL HYDROGENATION Quarterly Progress Report, Jan. - Mar. 1978
D. C. Cronauer, R. G. Ruberto, Y. T. Shah, and R. Modi Apr. 1978 54 p refs
(Contract EX-76-C-01-2305)
(FE-2305-21) Avail: NTIS HC A04/MF A01

Preparation of asphaltene samples for preliminary hydrogen transfer experiments was accomplished, and the experiments were started. The first samples of asphaltenes were recovered from distillation residues. (In this regard, asphaltenes were considered as the fraction insoluble in pentane and soluble in toluene). The levels of recoverable asphaltenes in the residues was shown to be 62 and 45%. Operating problems observed in the use of asphaltenes were primarily due to limitations of asphaltene solubility in tetralin. DOE

N79-29368# Oak Ridge National Lab., Tenn. Chemical Technology Div.
MATHEMATICAL MODEL OF THE HYGAS PILOT PLANT REACTOR
J. P. Meyer, J. W. Wells, J. R. Cox, J. P. Belk, and G. C. Frazier 1979 33 p refs Presented at the Am. Inst. of Chem. Engr., Houston, Tex., 1-5 Apr. 1979
(Contract W-7405-eng-26)
(CONF-790405-11) Avail: NTIS HC A03/MF A01

A mathematical model of the HYGAS pilot plant reactor was developed by subdividing the gasification process into the independent and sequential steps of devolatization, volatile cracking, rapid-rate methane formation, and slow-rate hydrogasification. Algorithms for each step were obtained from the literature for Montana lignite and Illinois No. 6 coal. Results from this work indicate that, for a given coal type, the product gas composition from the reactor does not vary significantly over the range of operating conditions. In general, results from the model compared favorably with pilot plant data for the gas composition, overpredicted the reported temperature profile, and were mixed with regard to the published extent of conversion, depending on coal type. Reasons for these discrepancies were attributable to inadequacies in model formulation, the assumption of adiabatic behavior, and uncertainties in the data. DOE

N79-29369# SRI International Corp., Menlo Park, Calif.
PRELIMINARY MARKET EVALUATION FOR GAS PRODUCED BY UNDERGROUND GASIFICATION OF WESTERN COAL
D. L. Olsen, A. J. Moll, R. L. Dickenson, C. A. Trexel, G. Crooks, and N. R. Teater Aug. 1978 92 p refs
(Contract EY-76-C-03-0115)
(SAN-0115-T124-1; SRI-6581) Avail: NTIS HC A05/MF A01

The technical development of underground coal gasification (UCG) depends on the success of existing private and governmental programs. Opportunities for application of UCG-derived fuel gas in existing industrial facilities are limited and site-specific. The potential market in the United States for competitively priced SNG from UCG-derived intermediate BTU gas (IBG) is essentially supply limited through the end of this century; that is, the nation's natural gas transportation and from the UCG sources likely to be developed by the year 2000. Retrofitting existing oil- or gas-fired power plants to accommodate IBG may be attractive in some cases as an alternative to a more costly conversion to coal-fired systems. Technical suitability, gas transportation costs, and ease of retrofit favor IBG over low BTU gas in applications for UCG-derived gases, such as chemical feedstocks, synthetic natural gas precursors, industrial fuels, or retrofit power plant fuels must be considered. DOE

N79-29370# Department of Energy, Washington, D. C. Energy Technology Center.
CLEAN ENERGY FROM COAL
Jan. 1979 36 p refs
(PETC-1000) Avail: NTIS HC A03/MF A01

The Pittsburgh Energy Technology Center (PETC) program to promote production of clean energy from coal is described. Established in 1948 as an energy research laboratory of the Office of Synthetic Liquid Fuels, U.S. Bureau of Mines, PETC is the largest fossil energy research and development center in the U.S. PETC has a staff of about 350 scientists, engineers, technicians, and support personnel and is the major Federal laboratory for research in coal combustion and conversion of coal to clean fuels. The laboratories were built in the late 1940's after the Congress passed the Synthetic Liquid Fuels Act of 1944. DOE

N79-29371# Elrick and Lavidge, Inc., San Francisco, Calif.
COMMERCIALIZATION FOCUS GROUP INTERVIEW: MEDIUM AND LOW Btu COAL GASIFICATION Summary Report
Aug. 1978 14 p
(Contract EV-78-C-01-6457)
(DOE/TIC-10029) Avail: NTIS HC A02/MF A01

DOE's background papers indicate that the technology necessary for commercialization of medium and low Btu coal gasification is available. All of the respondents agree with this statement. The federal government is seen as having a role to play in the commercialization of this fuel alternative, including funding a demonstration unit, guaranteeing loans for a few of the following units and providing protection for industry innovators by establishing an explicit, stable energy policy. The government's policy of price regulation is obviously of extreme importance to people considering the major financial expenditures necessary to make these fuel alternatives commercially available. DOE

N79-29372# Kaiser Engineers, Oakland, Calif.
TECHNICAL AND ECONOMIC FEASIBILITY STUDY FOR THE INDUSTRIAL UTILIZATION OF WASTE DERIVED FUEL GAS
Feb. 1979 50 p
(Contract EM-78-C-03-2092)
(SAN-2092-T1) Avail: NTIS HC A03/MF A01

A plan is presented for managing a technical and economic feasibility study for producing waste-derived fuel gas and using it as auxilliary fuel in a steel plant and in a California power plant. The project involves processing urban refuse, sewage, and agricultural (dairy) wastes to produce medium-Btu fuel gas to the users. The personnel requirements, procedures, documentation requirements, and time schedule, are outlined. DOE

N79-29373# Insitu Consulting, Laramie, Wyo.
BIBLIOGRAPHY OF SUBSIDENCE AND RELATED TOPICS FOR IN SITU COAL GASIFICATION
C. R. McKee and A. Serafini Oct. 1978 137 p refs
(LETC/BL-71316-1) Avail: NTIS HC A07/MF A01

The topics included are subsidence, subsidence models, material properties and in situ measurements, and hydrology of fractured media. Each topic is indexed by year and then alphabetically by author within each year. Abstracts of each article are included when available. DOE

N79-29374# California Univ., Davis. Dept. of Mechanical Engineering.
TRIAXIAL TESTS OF COAL GASIFICATION SAMPLES Final Report
H. Brandt 1978 223 p refs
(Contract W-7405-eng-48)
(UCRL-13968) Avail: NTIS HC A10/MF A01

Samples were obtained from core borings at Hoe Creek In-Situ coal gasification site at Campbell County, Wyoming. A total of forty-five triaxial tests were made in which overburden and interstitial pressures were kept constant. Data analysis such as geological grouping of the samples, determination of mathematical functions for stress and strain and development of failure envelopes was also performed. DOE

N79-29375# SRI International Corp., Menlo Park, Calif.
MISSION ANALYSIS FOR THE FEDERAL FUELS FROM BIOMASS PROGRAM. VOLUME 2: MISSION SELECTION, MARKET PENETRATION MODELING, AND ECONOMIC EVALUATION Final Report
Fred A. Schooley, Katherine A. Miller, Paul C. Meagher, Gwen Crooks, Claudia Grill, and Ronald L. Dickenson Dec. 1978 69 p refs
(Contract EY-76-C-03-0115-131)

(TID-29091) Avail: NTIS HC A04/MF A01

The market penetration model is described and the procedure used in selecting for analysis missions with potential for commercialization is identified. The inputs to the market penetration model are discussed, except for feedstock availability data. The model inputs include conventional fuel prices and demands and mission conversion economics. DOE

N79-29376# Department of Energy, Washington, D. C. Energy Information Administration.

ASSESSMENT OF POTENTIAL US PETROLEUM SUPPLY SHORTFALLS, 1978

Daniel Butler 2 Jun. 1978 14 p

(DOE/EIA-0102/38) Avail: NTIS HC A02/MF A01

The petroleum allocation model presented was developed by the EIA for the purpose of estimating future sources of petroleum imports to the United States and to calculate expected shortfalls in those imports that would result from supply interruptions. The model simulates total world trade in both crude oil and refined products and, in the case of a supply emergency, shares available petroleum supplies among member countries of the International Energy Agency as dictated in the International Energy Program. DOE

N79-29377# Princeton Univ., N. J. Dept. of Mechanical and Aerospace Engineering.

SYMPOSIUM ON ADVANCES IN SYNTHETIC FUELS PRESENTED BEFORE THE DIVISION OF PETROLEUM CHEMISTRY, AMERICAN CHEMICAL SOCIETY

M. J. Antal, Jr. and T. B. Reed (Solar Energy Research Inst., Golden, Colo.) 1978 9 p refs Meeting held at Miami Beach, Fla., 10 - 15 Sep. 1978

(Contract ET-78-F-02-5058)

(CONF-780902-16) Avail: NTIS HC A02/MF A01

The effects of gas phase temperature and residence time on the products of the pyrolysis/steam reforming of red alder pellets were investigated. Of the conditions studied, residence times of 6 to 9 seconds at 700 C produces the largest quantity of medium Btu gas from the pellets. The quantity of gas produced is less than one-half that obtained from cellulose under similar conditions. This relative paucity of gas yield may be an artifact of the pelletizing process, or it may reflect an inherent difficulty in gasifying red alder wood. More extreme conditions than examined here could be used to obtain higher gas yields. However, the high cost of reactors utilizing extreme conditions militates against their use for biomass gasification. More research is needed to determine the desirability of pelletized fuels for gasification processses, and the optimal conditions for steam pyrolysis/gasification of biomass. DOE

N79-29378# Badger Plants, Inc., Cambridge, Mass.

COAL-TO-GASOLINE CONCEPTUAL DESIGN AND MARKET EVALUATION OF METHANOL FUEL AND METHANOL-DERIVED GASOLINE Quarterly Technical Progress Report, 31 Jul. - 27 Oct. 1978

1978 11 p

(Contract EX-76-C-01-2416)

(FE-2416-37) Avail: NTIS HC A02/MF A01

Conceptual design work completed during the quarter on the conversion of coal to gasoline using the Mobil M-gasoline process is summarized. Preliminary work done on the marketing study for methanol is also summarized. DOE

N79-29379# Brookhaven National Lab., Upton, N. Y.

HYDROGEN TECHNOLOGY: AN OVERVIEW

F. J. Salzano, A. Mezzina, M. Beller, G. Strickland, and S. Srinivasan 1979 15 p Presented at the 177th ACS Natl. Meeting, Honolulu, Hawaii, 1 Apr. 1979

(Contract EY-76-C-02-0016)

(BNL-25760; Conf-790415-16) Avail: NTIS HC A02/MF A01

The key technologies needed for hydrogen to make major inroads into the U.S. energy economy as a fuel derived from renewable or abundant nonfossil resources is presented. The unique relationship between hydrogen and the fuel cell is discussed. The state-of-the-art of hydrogen transmission and storage are presented, and a scenario shows how the commercialization of the fuel cell as an electric-generating device in urban areas could lead to the introduction and use of hydrogen in a wider variety of end uses. At the present time there is a great deal of international interest in hydrogen. A broad picture of the activities of a number of western European countries and Japan in the area of hydrogen and a summary of international interest in this area is presented. DOE

N79-29380# Research Inst. of National Defence, Stockholm (Sweden).

METHODS FOR TESTING SOLID ROCKET FUEL. PART 2: COMPOSITE POWDER [METODER FOER PROVNING AV RAKETKRUT. II. KOMPOSITKRUT]

Anders Schwartz Feb. 1979 32 p refs In SWAHILI

(FOA-A-20031-D1) Avail: NTIS HC A03/MF A01

Methods for testing rocket engine solid fuel aging were studied in order to assure uniform testing criteria. Methods concerning density, hardness, explosion temperature, combustion time rate, traction resistance, thermal properties, extensibility, and glass temperature are described. For each method the apparatus, test conditions, and operating procedure are discussed. Author (ESA)

N79-29381# Office of Technology Assessment, Washington, D. C.

THE DIRECT USE OF COAL: PROSPECTS AND PROBLEMS OF PRODUCTION AND COMBUSTION

Apr. 1979 426 p refs

(PB-295797/5; OTA-E-86; LC-79-600071) Avail: NTIS HC A19/MF A01 CSCL 08I

The benefits and risks of a massive shift to coal and away from other fuels is assessed. The social, economic, physical, and biological impacts of such a shift is studied. The complete coal system, from extraction to combustion including the key steps and institutions that policy can influence is examined. The environmental impacts and possible effects on the public health are documented. Occupational and community impacts are examined. Technologies under development that might reduce cost, increase convenience of use, or mitigate negative impacts are reviewed. GRA

31 ENGINEERING (GENERAL)

Includes vacuum technology; control engineering; display engineering; and cryogenics.

N79-29382*# TRW, Inc., Cleveland, Ohio.

AUTOMATED PLASMA SPRAY (APS) PROCESS FEASIBILITY STUDY: PLASMA SPRAY PROCESS DEVELOPMENT AND EVALUATION Interim Report

C. W. Fetheroff, T. Derkacs, and I. M. Matay May 1979 117 p refs

(Contract NAS3-20112)

(NASA-CR-159579; TRW-ER-8019-1) Avail: NTIS HC A06/MF A01 CSCL 13H

An automated plasma spray (APS) process was developed to apply two layer (NiCrAlY and ZrO2-12Y2O3) thermal-barrier coatings to aircraft gas turbine engine blade airfoils. The APS process hardware consists of four subsystems: a mechanical blade positioner incorporating two interlaced six-degree-of-freedom assemblies; a noncoherent optical metrology subsystem; a microprocessor-based adaptive system controller; and commercial plasma spray equipment. Over fifty JT9D first stage turbine blades specimens were coated with the APS process in preliminary checkout and evaluation studies. The best of the preliminary specimens achieved an overall coating thickness uniformity of + or - 53 micrometers, much better than is achievable manually. Factors limiting this performance were identified and process modifications were initiated accordingly. Comparative evaluations of coating thickness uniformity for manually sprayed and APS coated specimens were initiated. One of the preliminary evaluation specimens was subjected to a torch test and metallographic evaluation. M.M.M.

N79-29383# Oak Ridge National Lab., Tenn.

CRYOGENIC RADIATION EFFECTS ON ELECTRIC INSULATORS

R. H. Kernohan, C. J. Long, and R. R. Coltman, Jr. 1979 5 p

refs Presented at 1st Topical Meeting on Fusion Reactor Materials, Miami Beach, Fla., 29 Jan. 1979
(Contract W-7405-eng-26)
(CONF-790125-38) Avail: NTIS HC A02/MF A01

Epoxy-based, polyamide, and polyimide insulators chosen from superconducting magnet practice were irradiated in liquid helium to a total gamma dose of 20 MGy. Electrical resistivity was measured during and after irradiation, and electrical breakdown was measured after irradiation. Mechanical properties measured at 77 K after irradiation included flexure strength, shear strength (of adhesive between copper), and compressive strength. DOE

N79-29384# Oak Ridge Y-12 Plant, Tenn.
AUTOMATIC TENSION CONTROL FOR WINDING SUPERCONDUCTING COILS
G. M. Henderson, J. C. Hung, and J. M. Googe 1979 8 p refs Presented at Southeastcon 79 IEEE Region 3 Conf. and Exhibit, Roanoke, Va., 1 Apr. 1979 Submitted for publication Prepared in cooperation with Tenn. Univ., Knoxville
(Contract W-7405-eng-26)
(Y/EN-257; Conf-790410-1) Avail: NTIS HC A02/MF A01

Root locus techniques were utilized in arriving at a suitable compensation network to stabilize the tension machine control system. Simulated tests of the system's response to a step input and to a pulse disturbance were performed. A mathematical model of the tension machine and the associated feedback control system is presented. A stability analysis of the system along with the applicability of a commercial controller for compensation requirements is discussed as well as simulated system responses to a step input and to a pulse disturbance. DOE

N79-29385# California State Dept. of Transportation, Sacramento. Office of Transportation Lab.
ANALYSIS OF SOLID WASTE MATERIALS IN HIGHWAY OPERATIONS Final Report
Richard B. Howell and Karl L. Baumeister Sep. 1978 88 p refs Sponsored by DoT
(PB-294230/8; TL-19703-657084; FHWA/CA-78/27) Avail: NTIS HC A05/MF A01 CSCL 13B

A survey of highway maintenance, construction operations and solid waste disposal methods was performed in 1973-77 to determine procedures that appear to have minimum environmental impacts on water quality. A field investigation was also performed at a field site where vegetative materials including trees, stumps and brush, were buried in a highway embankment. The study showed no adverse effects to groundwater. GRA

32 COMMUNICATIONS

Includes land and global communications; communications theory; and optical communications.

For related information see also *04 Aircraft Communications and Navigation* and *17 Spacecraft Communications, Command and Tracking.*

N79-29386 Rochester Univ., N. Y.
A STUDY ON THE FOUNDATION OF THE THEORY OF RADIATIVE ENERGY TRANSFER Ph.D. Thesis
Muhammad Suhail Zubairy 1978 145 p
Avail: Univ. Microfilms Order No. 7914507

The basic laws of the phenomenological theory of radiative energy transfer on the basic of the stochastic scalar wave theory are derived. An equation of radiative energy transfer in free space is derived which differs somewhat from the corresponding equation of the phenomenological theory. It reduces to the conventional form in the case of statistically homogeneous fields. The angular spectrum representation is obtained for the specific intensity and the propagation of specific intensity is then considered in a half space. The method of the theory of radiative energy transfer is used to study, in the paraxial approximation, some second-order coherence properties of beams produced by the Gaussian Schell-model sources. The radiative transport in a randomly fluctuating medium is studied using perturbation theory. Dissert. Abstr.

N79-29387 Illinois Univ. at Urbana-Champaign.
STUDIES IN SURFACE ACOUSTIC WAVE REFLECTORS Ph.D. Thesis
Roger Dale Fildes 1979 78 p
Avail: Univ. Microfilms Order No. 7915347

A narrowband filter which exhibits high Q's not obtainable with SAW transducer designs and utilizes an acoustic cavity formed by two high reflectivity reflectors is described. With standard frequency domain analysis techniques the determination of parameter values is highly susceptible to distortions caused by propagation losses, RF coupling, and transducer responses. An analysis of impulse response characteristics is shown to determine reflector parameters such as center frequency, single stripe edge reflectivity, and stored energy. The technique has particular importance as a measurement procedure because the results are essentially independent of the aforementioned distortions. Dissert. Abstr.

N79-29388 British Library Lending Div., Boston Spa (England).
AN ULTRA-WIDEBAND ANTENNA
I. T. Ivanov Dec. 1978 7 p ref Transl. into ENGLISH from Izv. Vyssh. Uchebn. Zaved., Radioelektron. (USSR), v. 13, no. 1, 1970 p 74-76
(BLL-RAE-Lib-Trans-2005-(5207); RAE-Lib-Trans-2005; BR67147) Avail: British Library Lending Div., Boston Spa, Engl.

A size reduced ultrawideband three element antenna is described. Each resonator element is a half wave dipole, tuned to long, medium, and short wave points in the frequency band, respectively. Size reduction of the dipoles is effected by employing a slow wave helical structure wound coaxially on an insulated tube. The helices are short-circuited at their outer ends to achieve broadbanding. The reported match of this antenna over four to five octaves is 1.5 VSWR. Author

N79-29389 British Broadcasting Corp., Kingswood (England). Research Dept.
NARROW-BAND FM SYSTEMS FOR TELEVISION LINKS: UHF BAND V FREQUENCY AVAILABILITY
D. Vinnell May 1979 9 p refs
(BBC-RD-1979/8) Avail: BBC, Kingswood Warren, Tadworth, Surrey, England

Narrow-band FM systems were investigated including assessments of mutual interference between the links and the projected UHF network for vestigial and double sideband systems at six typical outside broadcast sites. It is concluded that there would be no significant difference between the systems in terms of channel availability either before or after the introduction of the fourth television network on UHF. A.W.H.

N79-29390 British Broadcasting Corp., Kingswood (England). Research Dept.
THE MAXIMUM PERMISSIBLE INTERCHANNEL CROSSTALK FOR IMPERCEPTIBLE RESTRICTION OF STEREOPHONIC STAGE WIDTH
E. W. Taylor Apr. 1979 12 p refs
(BBC-RD-1979/7) Avail: BBC, Kingswood Warren, Tadworth, Surrey, England

The level of interchannel crosstalk at which stereophonic image movement away from the extreme left and right stage positions becomes imperceptible to the majority of observers is studied. Results are presented. A.W.H.

N79-29391 Maryland Univ., College Park.
THE VARIATIONAL TREATMENT OF STOCHASTIC SCATTERING PROBLEMS Ph.D. Thesis
Jerry Ames Krill 1978 131 p
Avail: Univ. Microfilms Order No. 7917383

Stochastic variational principles were formulated in vector-dyadic form to yield the statistical moments of the components of the scattered field amplitude for conducting and dielectric scatterers with random characteristics. In addition, a scalar form of the stochastic variational principle was applied to scattering from a model random surface consisting of two parallel, randomly separated hemicylinders on a conducting plane. The variational solution was compared with perturbational and exact solutions obtained for this surface. These comparisons demonstrated that the variational principle is more accurate than the corresponding

perturbational result and that it accounts for multiple scattering. Dissert. Abstr.

N79-29392 Minnesota Univ., Minneapolis.
DIGITAL SIGNALLING IN MULTI-USER DISPERSIVE CHANNELS Ph.D. Thesis
Alan Lee Kachelmyer 1979 166 p
Avail: Univ. Microfilms Order No. 7918352

An analysis and design is performed for several system configurations where the receivers are of the decision feedback equalizer form. The joint optimum transmitter and receiver filters are found for a single transmitter-receiver pair system operating in the presence of a fixed interference under a minimum mean squared error performance criterion both with and without constraints on the receiver. An optimum dual transmitter-receiver pair system is found using a minimum mean squared error performance criterion with no constraints on the receivers. Frequency division multiplexing must be employed in an optimum dual system design when the signal to noise ratios at the inputs to the receivers are at reasonable levels. Expressions for the optimum transmitter and receiver filters as well as for the mean squared error are given. Dissert. Abstr.

N79-29393 California Univ., Davis.
COHERENT AND NONCOHERENT DETECTION OF SIGNALS IN CYCLOSTATIONARY NOISE AND OF CYCLOSTATIONARY SIGNALS IN STATIONARY NOISE Ph.D. Thesis
Daniel Claudio Bukofzer 1979 368 p
Avail: Univ. Microfilms Order No. 7917148

An explicit general methodology for design of suboptimum noncoherent signal detectors is proposed and evaluated. The detectors are noncoherent in the sense that for known or partially known signals in additive cyclostationary (CS) noise and for CS random signals in additive stationary noise, the detectors do not employ periodically time-varying components that are synchronized to the statistical periodicity of the CS noise or CS signal. However, the detectors can be synchronized to non-statistical periodicities in the known or partially known signals. The suboptimum detectors proposed are optimum for stationary signal and noise models obtained by stationarization of the CS signal and noise models. The design methodology for suboptimum noncoherent detectors is evaluated by comparison of probability of detection-error for the optimum coherent and suboptimum noncoherent detectors. Only noises that are white Gaussian (WGN) and only random signals that are Gaussian are considered. Dissert. Abstr.

N79-29394 California Univ., Santa Barbara.
COMPUTER SIGNAL ANALYSIS AND VARIABILITY OF ACOUSTIC PARAMETERS IN PHONETICS Ph.D. Thesis
Gerard F. A. Chollet 1978 191 p
Avail: Univ. Microfilms Order No. 7915625

Conversational speech was compared to laboratory speech in an attempt to determine if laboratory analyses of speech adequately reflected the acoustic characteristics of natural speech. The corpus for the study consisted of half-hour surreptitiously recorded conversations with fifty upper middle class Parisian speaker/listeners. The preliminary analysis of some of these speech samples using the sound spectrograph revealed that the acoustic parameters of conversational speech were quite variable. Therefore, a large number of measurements needed to be made in order to obtain reliable estimates of the underlying distributions. Because of the size of the data base, digital signal analysis techniques were employed. Dissert. Abstr.

N79-29395# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
OPTIMIZATION OF THE SUBREFLECTOR PROFILES OF A CASSEGRAIN TYPE ANTENNA INCLUDING THE DIFFRACTION EFFECTS [OTIMIZACAO DO PERFIL DO SUBREFLETOR EM ANTENAS TIPO CASSEGRAIN INCLUINDO EFEITOS DE DIFRACAO]
Lucio Baptista Trannin Cividanes Feb. 1979 148 p refs In PORTUGUESE
(INPE-1424-TDL/04) Avail: NTIS HC A07/MF A01

A method for determining the subreflector shape which optimizes aperture efficiency in a Cassegrain type antenna is presented. A computer program is also described which, within the geometrical optics approximations, determines the aperture illumination of a Cassegrain type antenna with any given circularly symmetric subreflector. Diffraction effects are included using the geometrical theory of diffraction in conjunction with an expression for the efficiency which involves the application of the reciprocity theorem to the antenna. The developed theory is illustrated through various examples showing good agreement with theoretical and experimental results. K.L.

N79-29396# Aeronautical Research Labs., Melbourne (Australia).
TRANSMISSION OF SIGNALS VIA LAND LINE FOR MAGNETIC TAPE COPYING AND OTHER APPLICATIONS
K. F. Fraser and U. R. Krieser Aug. 1978 100 p refs
(ARL/Mech-Eng-Note-370; AR-01-300) Avail: NTIS HC A05/MF A01

The techniques described enable analogue or digital signals reproduced using one magnetic tape machine to be transmitted via land line cable and copied using another machine situated remotely (at least up to 270 meters). Also signals, generated using transducers for example, may be transmitted from a remote location to a tape recording machine or other receiving equipment. A frequency divider in conjunction with standard magnetic tape reproducer hardware provides a simple means of the low pass filtering of data recorded in frequency modulated form. Consideration is given to the production of an intermediate tape with filtered data. Author

N79-29397# Sperry Research Center, Sudbury, Mass.
LOW EM SIGNATURE RESPONSE TECHNIQUES Final Technical Report, Sep. 1977 - Oct. 1978
C. L. Bennett, H. Mieras, S. L. Teeter, and J. P. Tommey RADC Griffis AFB, N. Y. Mar. 1979 117 p refs
(Contract F30602-77-C-0166; AF Proj. 2314)
(AD-A068211; SCRC-CR-78-61; RADC-TR-78-287) Avail: NTIS HC A06/MF A01 CSCL 17/9

This study extends the technique for computing the smoothed impulse response to the case of scattering from triangular plates, quadrilateral plates, and more refined aircraft models that consist of a cylindrical fuselage with triangular or quadriilateral plates for the wings, stabilizers, and rudder. To the knowledge of Sperry, this is the first time that a successful solution of these problems has been obtained. The numerical techniques developed consisted of the simultaneous solution of two vector space-time integral equations. A major effort was required in order to handle non-rectangular plate geometries. The resulting numerical procedure consisted of a set of local coordinate transformations in the plate edge regions in order to be able to properly satisfy the boundary conditions on the surface currents. Results were computed for several triangular plates, finned cylinders, and a MIG-21 aircraft model. These results were found to be in good agreement with measurements taken on the Sperry time domain scattering range. In addition, measured results were obtained for the response of scattering centers when coated with RAM (Radar Abosrbing Materials). These results show that RAM can lower the scattered response but that the amount of reduction is dependent upon the spectrum of the illumination and the aspect angle. Moreover, there were several frequencies where the RCS experienced nulls of an additional 8-10 db. GRA

N79-29398# Pacific-Sierra Research Corp., Santa Monica, Calif.
ELF PROPAGATION UNDER DISTURBED CONDITIONS, COMPARSION OF THEORY WITH AVAILABLE DATA Final Report, 1 Nov. 1976 - 1 Dec. 1978
E. C. Field 1 Dec. 1978 57 p refs
(Contract DNA001-77-C-0039)
(AD-A068497; AD-E300506; PSR-813; DNA-4700F) Avail: NTIS HC A04/MF A01 CSCL 20/14

An extensive literature survey has identified a number of low-frequency noise measurements relevant to the effects of ionospheric disturbances on ELF propagation. These measurements pertain to the behavior of earth-ionosphere cavity resonances and ELF/VLF noise intensity at the time of: (1) the Starfish high-altitude nuclear detonation, (2) more than thirty solar flares, and (3) two polar-cap-absorption events (PCAs). Until controlled-source ELF experiments are carried out under disturbed conditions, these collateral data provide the only means by which codes that predict ELF propagation in nuclear environments can be compared with experiment. A full-wave propagation code

similar to predictive codes developed under DNA auspices is used to compute ELF propagation anomalies due to Starfish, PCA events, and a large number of model x-ray flares. The results of these calculations are compared--to the extent possible--to the available data. Despite the inadequacies of the data, we are able to verify key theoretical predictions. Good agreement is demonstrated between code predictions and ELF/VLF noise intensity during solar flares. Both experiment and theory consistently show that the vast majority of flares cause the intensity to increase at frequencies between 30Hz and 1 kHz, decrease between 5 kHz and 10 kHz, and increase between 10 kHz and 30 kHz. This agreement, which occurs over three frequency decades, strongly implies the correctness of the predictive codes. Author (GRA)

N79-29399# Ohio State Univ., Columbus. Electroscience Lab.

A FUNDAMENTAL INVESTIGATION OF A HYBRID TECHNIQUE FOR GENERAL ELECTROMAGNETIC SCATTERERS AND ANTENNAS Final Report, 1 Feb. 1976 - 31 Jan. 1979

Gary A. Thiele Mar. 1979 10 p
(Contract N00014-76-C-0573)
(AD-A068209; ESL-784372-8) Avail: NTIS HC A02/MF A01 CSCL 17/9

The general purpose of this three year effort was to develop theoretical/numerical methods for the solution of electromagnetic problems. Of particular interest in this work was the continued development of the hybrid technique which combines the moment method treatment of wire antennas with the GTD for large conducting surfaces. GRA

N79-29400# National Communications System, Washington, D. C.

VOCABULARY FOR FIBER OPTICS AND LIGHTWAVE COMMUNICATIONS Interim Report. Technical Information Bulletin

Martin H. Weik Feb. 1979 141 p
(AD-A068510; AD-E100206; NCS-TIB-79-1) Avail: NTIS HC A07/MF A01 CSCL 20/6

A dictionary containing approximately 1430 entries, including inversions and cross-references, covering fiber optics and lightwave communications terms and their definitions. Author (GRA)

N79-29401# Human Engineering Labs., Aberdeen Proving Ground, Md.

NATO RESEARCH STUDY GROUP ON PATTERN RECOGNITION Final Report, Nov. 1971 - Jan. 1978

David C. Hodge, Bruno Beek, John S. Dehne, Russell B. Ives, and Heywood E. Webb, Jr. Apr. 1979 77 p refs
(DA Proj. 1L1-61102-B-74A-00)
(AD-A068821; HEL-TM-5-79) Avail: NTIS HC A05/MF A01 CSCL 17/8

AC/243 (Panel III) RSG-4 on Automatic Pattern Recognition was established in 1971 to promote information exchange on military pattern recognition projects, and to identify topics of mutual concern suitable for cooperative research. RSG-4 developed a topical classification scheme, exchanged project summaries, performed three technology assessments, and initiated two cooperative research programs. This paper describes NATO organization for cooperation on military problems, surveys the current cooperative research efforts, notes the group's failures, and touches on the prospects for future NATO activity in this area. Previously unpublished analyses of military problems in automatic pattern recognition are included. Author (GRA)

N79-29402# Naval Postgraduate School, Monterey, Calif.

DESIGN PARAMETERS AND COLOR CRT DISPLAY DESIGN

D. E. Neil Feb. 1979 41 p refs
(AD-A068584; NPS55-79-05) Avail: NTIS HC A03/MF A01 CSCL 09/1

This report considers a number of the principal variables worthy of inclusion in any attempt to apply color coding to CRT display design. GRA

N79-29403# Stanford Univ., Calif. Information Systems Lab.

RESEARCH ON ADAPTIVE ANTENNA TECHNIQUES 3. PART 1: THE SOFT CONSTRAINED LMS ALGORITHM. PART 2: AN IMPROVED ADAPTIVE SEPARATOR Final Report

Bernard Widrow, Richard Chestek, and Timothy Saxe 31 Jan. 1979 81 p refs
(Contract N00019-78-C-0276)
(AD-A068660) Avail: NTIS HC A05/MF A01 CSCL 17/4

This research is concerned with separation of desired signals and jamming signals based on their relative power levels. The jammers are assumed to be strong compared to the desired signals, otherwise they are of no concern since other methods can be used to eliminate them. In Part 1, we develop 'soft constraint' adaptive algorithms that are suitable for power separation with adaptive arrays. Signals and jammers of various power levels can be separated as long as they differ in angle of arrival and/or frequency band. In Part 2, we develop single channel power separators with sharper thresholds than have been previously possible. Such systems can separate signals and jammers of various power levels as long as they differ in frequency band. The goal is to study sharp threshold phenomena in the simpler context of single channel operation with the expectation of final application to multichannel adaptive arrays. GRA

N79-29404# Massachusetts Inst. of Tech., Cambridge. Electronic Systems Lab.

DETERMINISTIC FEEDBACK CODING SCHEMES FOR THE ADDITIVE WHITE GAUSSIAN NOISE BROADCAST AND MULTIPLE-ACCESS CHANNELS

Lawrence H. Ozarow and S. K. Leung-Yan-Cheong Jan. 1979 31 p refs
(Contract N00014-75-C-1183)
(AD-A068236; ESL-P-760) Avail: NTIS HC A03/MF A01 CSCL 09/4

Models of the additive white Gaussian noise (AWGN) broadcast channel with feedback are analyzed. A deterministic coding procedure is proposed which allows reliable transmission at all rate points inside the capacity regions of these models. A deterministic coding scheme for the AWGN multiple-access channel with feedback is also evaluated. This scheme achieves rate points beyond those found by Cover and Leung. GRA

N79-29405# Naval Research Lab., Washington, D. C.

INVERSE SCATTERING THEORY AND PROFILE RECONSTRUCTION

Arthur K. Jordan and Saeyoung Ahn 17 Apr. 1979 28 p refs
(AD-A068331; NRL-MR-3981) Avail: NTIS HC A03/MF A01 CSCL 20/14

An analytic method for the reconstruction of the profiles of refractive indices of inhomogeneous, stratified regions is presented. The reflection coefficient, r(k), for time-harmonic electromagnetic waves is represented as a rational function of k, the wave number. One-dimensional inverse scattering theory has been applied to obtain analytic, closed-form expressions for the profile functions, q(x), from r(k). The profile reconstruction method is demonstrated with a three-pole r(k), the yields q(x) which resembles an ionospheric electron density profile previously analyzed by direct scattering methods. The present communication generalizes previous results to oblique incidence and compares several q(x) obtained from different rational approximations to r(k). GRA

N79-29406# Ohio State Univ., Columbus. Electroscience Lab.

THE CALCULATION OF FAR FIELD SCATTERING BY A CIRCULAR METALLIC DISK

D. B. Hodge Feb. 1979 40 p refs
(Contract N00014-78-C-0049)
(AD-A068208; ESL-710816-2) Avail: NTIS HC A03/MF A01 CSCL 17/9

A computer program for the general problem of far field scattering by a thin, circular, metallic disk is described. This program permits incident plane EM waves of arbitrary incidence direction and polarization and computes the amplitude and phase of both components of the scattered field at any point on the far field sphere. Thus, the program is applicable to any monostatic or bistatic far field scattering geometry. The program is based on Andrejewski's rigorous eigenfunction solution to the disk

scattering problem. This report describes the solution and required spheroidal functions as well as the resulting program and its use. Author (GRA)

N79-29407# Georgia Inst. of Tech., Atlanta. Electromagnetic Effectiveness Div.
NEAR-FIELD THEORY AND TECHNIQUES FOR WIDEBAND RADIATING SYSTEMS AT IN-BAND AND OUT-OF-BAND FREQUENCIES Interim Technical Report, 15 Jun. 1978 - 31 Jan. 1979
B. J. Cown and C. E. Ryan, Jr. Apr. 1979 45 p refs
(Contract DAAG29-78-C-0029)
(AD-A068193; GIT/EED-A-2179-ITR-1; ARO-15646.1-EL; ITR-1) Avail: NTIS HC A03/MF A01 CSCL 20/14

This report summarizes the results achieved to date in the research program concerning wideband in-band and out-of-band radiating systems. The research program is primarily devoted to a basic study of methods to characterize wideband radiating systems performance and the applications of near-field techniques to such characterizations. Accordingly, the overall research program is divided into four major tasks that are designed to provide a systematic approach to understanding and solving the complex electromagnetic effectiveness problems inherent in out-of-band phenomena. GRA

N79-29408# Naval Research Lab., Washington, D. C.
ELECTROMAGNETIC SCATTERING PATTERNS FROM SINUSOIDAL SURFACES Interim Report
Arthur K. Jordan and Roger H. Lang 10 Apr. 1979 21 p refs
(AD-A068369; NRL-8284) Avail: NTIS HC A02/MF A01 CSCL 20/14

In this paper we present an analysis and calculation of scattering patterns from sinusoidal surfaces. An exact space-harmonic representation is used for the field on the surface and, as a result, the calculation includes the effects of shadowing, diffraction, and multiple scattering. An asymptotic evaluation has been employed to obtain an exact expression for the scattering pattern as a product of the space-harmonic scattering coefficients times the corresponding pattern functions. The formula obtained has been simplified for illuminated areas that are many wavelengths long and plotted for a variety of surface parameters. The present method for scattering calculations can be considered to be complementary to methods using physical-optics and point-matching techniques. In addition to presenting the scattering-pattern calculations, the report includes the computation of the exact Bragg backscattering amplitudes and compares them to their Rayleigh approximations. Author (GRA)

N79-29409# Decision-Science Applications, Inc., Arlington, Va.
BISTATIC CLUTTER ANALYSIS Final Technical Report, 30 Sep. 1977 - 30 Nov. 1978
R. E. VanderSchuur and P. G. Tomlinson Griffiss AFB, N.Y. RADC Apr. 1979 99 p
(Contract F30602-77-C-0198; ARPA Order 3071)
(AD-A069385; DSA-106; RADC-TR-79-70) Avail: NTIS HC A05/MF A01 CSCL 17/9

This report describes the analysis performed by Decision-Science Applications, Inc., (DSA) on bistatic clutter data collected by the Enviromental Research Institute of Michigan (ERIM) during early 1978. This data consisted of measurements of bistatic radar cross section per unit (sigma sub O) of the terrain at two Michigan sites, using an airborne transmitter and a tower-mounted receiver. Reflectivity was measured (simultaneously) at L- and X-band, at both horizontal-horizontal (HH) and horizontal-vertical (HV) polarizations. The measurement objective was to obtain X- and L-band ground-clutter sigma sub O statistics for large bistatic angles and out-of-plane geometries. DSA received this calibrated bistatic sigma sub O data from ERIM in the form of calibrated magnetic tape recordings and analog plots; the data was extensively analyzed for internal consistently and correlated against other relevant and related data and theoretical models. This report presents the results and conclusions of these analyses. DSA found that the levels and trends exhibited by this data were quite different from previous data and models. GRA

N79-29410# Battelle Columbus Labs., Durham, N. C.
PERFORMANCE AND COST ANALYSIS OF A COMMAND-GUIDED BALLISTIC MISSILE RADAR
G. W. Ewell and E. K. Reedy Redstone Arsenal, Ala. Army Missile Research and Development Command Mar. 1979 101 p refs
(Contract DAAG29-76-D-0100; DA Proj. 1T1-61101-A-91A)
(AD-A069514; DRDMI-T-CR-79-18) Avail: NTIS HC A06/MF A01 CSCL 17/9

This report addresses many of the technical questions associated with developing and implementing a command-guided ballistic rocket using a microwave or millimeter radar to provide position and roll information for the rocket. The basic feasibility of an X-band radar for providing the rocket position and roll data was established in the first phase of this design study. The second phase of the investigation concentrated on providing additional depth in the treatment of the missile retroreflector configurations, more detailed performance and cost trade-offs among the beacon and passive reflector-equipped missile concepts, missile beacon transponder design tradeoffs and a recommended design configuration, and an analytical examination of multiple rocket tracking system concepts and tracking radar requirements. GRA

N79-29411# Swedlow, Inc., Garden Grove, Calif.
MANUFACTURING METHODS AND TECHNOLOGY (MM AND T) PROJECT TO ESTABLISH PRODUCTION TECHNIQUES TO MANUFACTURE RIGID ARMOR FOR RADAR ANTENNA HARDENING Quarterly Report, 1 Dec. 1978 - 28 Feb. 1979
R. Doerr Mar. 1979 29 p
(Contract DAAB07-77-C-0476)
(AD-A069395; QR-7) Avail: NTIS HC A03/MF A01 CSCL 19/4

This program is being conducted to establish production techniques and production capabilities for manufacture of plastic armor panels intended to provide ballistic protection for flat radar antennae. Technical fabrication problems were reassessed and subscale process development initiated to solve these problems. Subscale panels, fabricated during the period, demonstrated progress in the elimination of several of the processing problems. Overall panel opacity, surface delaminations, and voids or trapped air were brought under control. The reduction of preconditioning temperatures to less than 180 F and a reduction of the lamination time eliminated the opacity problem. Application of a woven polypropylene fabric as protective face plies eliminated the surface delamination or non-lamination problem on the limited number of samples fabricated this period. The utilization of silicon sponge rubber seals improved the degassing efficiency and evacuation capabilities during processing. Minimal voids or air entrapment were the result. The process revisions required to accomplish the above were defined. GRA

N79-29412# Army Communications Command, Fort Huachuca, Ariz.
STANDARD ENGINEERING INSTALLATION PACKAGE. WIDEBAND SECURE VOICE NETWORK EXTENSION PROJECT Final Report
18 May 1979 369 p
(AD-A069738; ACC-SEIP-035) Avail: NTIS HC A16/MF A01 CSCL 17/2

This Standard Engineering Installation Package (SEIP) provides guidance for detailed planning, engineering, installing, and testing of link interconnect equipment used to interface secure voice terminal equipment to satellite or other terrestrial media. Document includes site survey and data checklist, installation specifications and instructions, engineering installation drawings, and operational test procedures. Author (GRA)

N79-29413# Sperry Research Center, Sudbury, Mass.
SECURE OPTICAL MATRIX SWITCH Final Technical Report, 15 Jun. 1977 - 15 Jun. 1978
Richard A. Soref Apr. 1979 106 p refs
(Contract F19628-77-C-0187)
(AD-A069623; SCRC-CR-78-35; RADC-TR-79-51) Avail: NTIS HC A06/MF A01 CSCL 17/2

Novel fiber-optic switching arrays have been developed to control the network configuration of a secure fiber-optic intercom system. A fiber-linked system containing six optical data terminals was built and has been matrix-switched by a multimode 3 x 2

array constructed in a 80-micrometers-thick single-crystal LiTaO3 plate. Commercial multimode 0.15 NA fibers, 85-micrometers core diameter, have been directly and permanently coupled to the plate ends at the matrix input and output ports, one strand for each data channel. Using oblique incidence, the fiber light cone was collimated by a factor of 2.6 in the crystal. The optical data sources consisted of GaAs LEDs emitting at the 0.90 m wavelength. Electrically controlled optical switching has been obtained with unpolarized TE- and TM-mode light launched in the crystal. GRA

N79-29414# Delta Information Systems, Inc., Jenkintown, Pa.
CRITERIA FOR THE EVALUATION OF TWO-DIMENSIONAL CODING TECHNIQUES FOR USE IN DIGITAL FACSIMILE TERMINALS Final Report
Richard Schaphorst and Neil Randall May 1979 44 p refs (Contract DCA100-79-M-0034)
(AD-A069686; AD-E100223; NCS-TIB-79-6) Avail: NTIS HC A03/MF A01 CSCL 09/2

This report describes proposed criteria to evaluate the relative technical/economic merits of competing two-dimensional compression algorithms submitted by member nations to CCITT Study Group XIV for adoption as an international standard. In addition, appendix A contains a draft proposed contribution by the United States of America to the CCITT entitled Criteria for the Evaluation of Two-Dimensional Coding Techniques for use in Digital Facsimile Terminals. Author (GRA)

N79-29415# Fondazione Ugo Bordoni, Rome (Italy).
ON THE DEVELOPMENT OF A DEVICE FOR THE INSERTION OF A DIGITAL SIGNAL TIME-BASE JITTER [PROGETTO DI UN DISPOSITIVO PER L'INSERIMENTO DI JITTER DI TEMPORIZZAZIONE IN UN SEGNALE NUMERICO]
Domenico DeSeta and Giorgio Fruscalzo Nov. 1978 37 p In ITALIAN
(FUB-21-1978) Avail: NTIS HC A03/MF A01

Design of a time-base jitter device was undertaken, a model was prepared and some laboratory results were obtained. The device is used for jitter transfer measurements through digital data transmission circuits including one or several regenerative repeaters and to measure jitter tolerance in related equipment. The design was based on analog voltage to delay converter circuits using TTL logic and MOS switches. Oscilloscope displays are shown for three different types of synchronization. The net maximum propagation delay for the experimental device is about 320 ns. Author (ESA)

33 ELECTRONICS AND ELECTRICAL ENGINEERING

Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.

For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics*.

N79-29416 British Library Lending Div., Boston Spa (England).
INTEGRATED BALLASTS FOR DISCHARGE LAMPS
I. Macat, M. Vinduska, and J. Sladecek May 1979 15 p refs Transl. into ENGLISH from Energetika (Czechoslovakia), v. 28, no. 10, 1978 p 445-448
(BLL-RTS-11843) Avail: British Library Lending Div., Boston Spa, Engl.

The properties of an integrated ballast whose design is based on the principle of an integrated inductance-capacitance element are presented. The all in one ballast combines the functions of a choke, the capacitor, and a signal suppressor. M.M.M.

N79-29417 Carnegie-Mellon Univ., Pittsburgh, Pa.
METALS AND SEMICONDUCTING METAL-OXIDES IN INTEGRATED DEVICES IN CONJUNCTION WITH SILICON FOR SOLID STATE GAS DETECTION Ph.D. Thesis
David Joseph Leary 1979 368 p
Avail: Univ. Microfilms Order No. 7916178

Schemes for obtaining information about the gas ambient from a change in a physical or electrical property of a semiconductor are considered. The focus is on materials whose electrical properties are influenced by the gas ambient by reactions that occur directly between gas and solid. This refers to adsorption and absorption processes where electrical properties are influenced by charge transfer and scattering mechanisms. Gas sensors incorporating these materials were developed which respond to a wide range of flammable and toxic gases. Monolithic versions employing standard silicon planar processing are desired. Dissert. Abstr.

N79-29418 Pittsburgh Univ., Pa.
THE EFFECT OF A PARALLEL GAS-DIELECTRIC INTERFACE ON THE DIELECTRIC RECOVERY CHARACTERISTICS FOLLOWING ARC INTERRUPTION Ph.D. Thesis
Ezzat Bashandy Khalafalla 1978 143 p
Avail: Univ. Microfilms Order No. 7917449

The experimental measurements of dielectric breakdown voltage were carried out under Bus fault conditions. Dielectric breakdown voltages were considerably lower than the values predicted by the theoretical models. The use of mathematical techniques to predict the dielectric breakdown voltage with and without the influence of solid dielectrics on reducing the interrupting capability of the circuit breaker using a suitable computer program was presented. A mathematical model was developed to predict the dielectric breakdown performance of the test interrupter. The procedure followed to define the necessary parameters was described to provide a guide for future efforts of this nature. The abilities and limitations of this model technique were evaluated. Dissert. Abstr.

N79-29419 California Univ., Santa Barbara.
DISCRETE-TIME FILTERING FOR SYSTEMS EVOLVING IN A LIE GROUP Ph.D. Thesis
Carl Johnson 1979 133 p
Avail: Univ. Microfilms Order No. 7916969

A finite dimensional filtering solution is developed for discrete-time dynamical systems evolving in a Lie group by unifying the theories of Brownian motion and sufficient statistics. The theory provides a framework whereby the essential ingredients required to structure a recursive finite dimensional filtering solution are identified. A system observability condition based on the existence of a conjugate density class was obtained. The theory was extended to disconnected Lie group systems using factor group results. Two formulations of a multiplicative system yielded nonlinear filtering algorithms. Systems having both multiplicative and additive noise were studied in the structural framework offered by the affine group with no concrete results in terms of a complete filtering solution. Dissert. Abstr.

N79-29420 Virginia Univ., Charlottesville.
SUPERCONDUCTING NIOBIUM VARIABLE THICKNESS BRIDGES: CHARACTERISTICS AND PROPERTIES AS MICROWAVE MIXER Ph.D. Thesis
Li-Kong Wang 1978 117 p
Avail: Univ. Microfilms Order No. 7916337

Niobium variable thickness bridges designed for millimeter wave mixing were fabricated and tested. The junction characteristics were studied by measurements of I-V and dV/dI vs. V as functions of temperature, microwave power and microwave mixing. Near T sub C these bridges behaved as nearly ideal Josephson junctions but at lower temperatures their characteristics are determined by flux flow. Hysteresis of the I-V curves, depression of the energy gap, a feature interpreted as the onset of a self-sustaining hot spot, and bolometric mixing are described by a simple heating model. The mixing experiments both at 10 GHz and 85 GHz were described as a measurement of the device properties at high frequencies. Junctions made on semiconductor substrates to provide better cooling were used in 85 GHz mixing experiments. Dissert. Abstr.

N79-29421 Stanford Univ., Calif.
THE PICOSECOND TRANSIENT GRATING TECHNIQUE: STUDIES ON ENERGY TRANSPORT AND PHOTOACOUSTIC EFFECTS Ph.D. Thesis
Jose Ribera Salcedo 1979 114 p
Avail: Univ: Microfilms Order No. 7917276

The further development of the picosecond transient grating

technique and its application to the study of energy migration between identical impurity molecules in molecular crystals are reported. This technique relies on the production of a transient diffraction grating of molecular excited states to directly probe the time-dependent position of the excited states in the bulk of the molecular crystals. The observation of strong photoacoustic effects in molecular crystals, and particularly the observation of an acoustooptic amplitude grating effect, obtained when the picosecond transient grating experiments were performed at optical excitation intensities above approximately 500 MW/sq cm are also reported. A strong well defined oscillatory behavior in the scattering efficiency versus decay was observed.
Dissert. Abstr.

N79-29422 Stanford Univ., Calif.
A CONSTRAINED ADAPTIVE RECURSIVE FILTER FOR ENHANCING NARROWBAND SIGNALS IN WHITE NOISE Ph.D. Thesis
Paul Anthony Thompson 1979 98 p
Avail: Univ. Microfilms Order No. 7917285

The extraction of a narrowband signal of unknown and possibly time varying frequency from a background of white noise is presented. The technique described for overcoming the difficulty of adopting the feedback coefficients involves the use of an appropriately chosen constraint between feed-forward and feedback coefficients. This constraint acts to slave each of the filter poles to a corresponding zero of an adaptive linear predictor embedded in the recursive filter. In so doing it facilitates the formation of a resonant response appropriate for enhancing a narrowband signal. For analysis of the constrained adaptive filter, a differential-equation model of the expected behavior of the adaptive process is developed. Dissert. Abstr.

N79-29423 Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
OPTIMAL FEEDBACK CONTROLS FOR PARAMETER IDENTIFICATION Ph.D. Thesis
David Nelson Olmstead 1979 182 p
Avail: Univ. Microfilms Order No. 7912875

The improvement of the estimates of unknown constant parameters in the plant and control matrices of a linear discrete system from noisy measurements by the use of a control consisting of a feedback term and open-loop term was investigated. The feedback term allows one to move the poles of the system to locations which improve the information in the output about the parameters beyond that attainable with only open-loop control inputs. The procedure is developed for the multiple parameter and multiple input control cases. Examples are used to demonstrate the enhancement of parameter identification gained by adding feedback control of an open-loop control input.
Dissert. Abstr.

N79-29424 Arizona Univ., Tucson.
SYNTHESIS AND SENSITIVITY ANALYSIS OF ELLIPTIC NETWORKS Ph.D. Thesis
David Jose Miguel BaezLopez 1979 92 p
Avail: Univ. Microfilms Order No. 7917331

The theory of elliptic passive filters was described. From this theoretical treatment an algorithm was developed to obtain the desired elliptic passive filter element values in terms of specified resistance termination, passband ripple, and stopband frequency. Dissert. Abstr.

N79-29425 Oklahoma Univ., Oklahoma City.
ANALYSIS OF MULTI-VALUED COMBINATIONAL CIRCUITS USING DIGITAL CALCULUS Ph.D. Thesis
Yousef Mohammed Ajabnoor 1979 167 p
Avail: Univ. Microfilms Order No. 7918735

Boolean differential calculus is extended to a more general calculus which is applicable to not only binary switching systems and Boolean switching systems, but also multi-valued switching systems and is called multi-valued digital calculus or simply digital calculus. The theory that is necessary for developing nonbinary digital systems is investigated. Potential implementable multi-valued algebras are discussed and the multi-valued digital systems derived from them are studied. Two general procedures, one for static-hazard detection and one for static-hazard elimination after they are detected, in a multi-valued combinational circuit are presented. Dissert. Abstr.

N79-29426 Michigan Univ., Ann Arbor.
PERFORMANCE LIMITATIONS AND SYNTHESIS OF MATCHED BROADBAND SHUNT-COMPENSATED LINEAR AMPLIFIERS Ph.D. Thesis
David John Ahlgren 1979 416 p
Avail: Univ. Microfilms Order No. 7916654

The problem of deriving simultaneous bounds on port reflections and broadband gain in amplifiers based on unilateral active devices is treated. The bounds derived are based on elements of an extrinisic hybrid-pi transistor model. Estimates provide a means to assess the potential performance of a transistor as a wide-band shunt-compensated amplifier before considerable effort is expended in synthesis. Fano's integrals provide the basis for the computation of bounds. When coupled with broadband gain equations, a system of relationships which relate port reflection coefficient magnitudes to transducer power gain results. Several design examples are presented, and the measured characteristics of three prototypes are discussed. The design of an integrable inductorless amplifier is included. Dissert. Abstr.

N79-29427 Ohio Univ., Athens.
BROADBAND IMPEDANCE-MATCHING NETWORKS Ph.D. Thesis
Tavatchai Chaisrakeo 1979 187 p
Avail: Univ. Microfilms Order No. 7918033

The design of broadband impedance-matching networks on load impedances which consist of a resistive load, Bode's RC load, and an inductor L in series with an RC parallel combination load is considered. The study is divided into two areas. The first area is the investigation of low pass filters with elliptic response and the second, bandpass filters with Butterworth and Chebyshev responses. Dissert. Abstr.

N79-29428 North Carolina State Univ. at Raleigh.
ERROR ANALYSIS OF NEW APPROACHES TO HIGH ACCURACY Q-FACTOR MEASUREMENT Ph.D. Thesis
Youn-Ho Choung 1979 204 p
Avail: Univ. Microfilms Order No. 7915561

Cavity resonators were measured in the upper region of microwave frequencies. Procedures were developed at X-band frequencies. The rho-method was used for repetitive measurements. The rho-method gives a very high measurement accuracy. The complete procedure of the rho-method was analyzed. The method provides a valuable tool for determining Q-factors. The dependence of the Q-factor on the temperature was determined. A range from 10 C to 90 C at X-band frequencies was explored. The circuitry of the system and some components were tested. Approximate equations were used in the evaluation of the result representing the coupling elements by equivalent normalized shunt susceptances. To obtain improved accuracy, the coupling elements are represented as two-port devices. The matrix elements for describing the two ports are found by measurement of impedances, and scattering coefficients. Dissert. Abstr.

N79-29429 Maryland Univ., College Park.
A SAMPLING APPROACH TO THE MEASUREMENT OF LOW FREQUENCY VOLTAGE WAVEFORMS Ph.D. Thesis
Bruce Frederic Field 1978 222 p
Avail: Univ. Microfilms Order No. 7917380

A model for the accelerometer signal and sampling algorithms for accurately analyzing the signal are presented. Investigation of a nonlinear least squares estimation technique proved the method impractical due to the excessive calculation time required. By applying constraints on the sampling rate, a significant reduction in calculation time was accomplished through the use of a fast Fourier transform algorithm. An improved signal model incorporating frequency modulation was deduced from actual measurements using the previously developed algorithms. Integration methods providing accurate measurement of the RMS value of the frequency modulated signal were examined and successfully applied to the measurement problem. Based on these algorithms a measuring instrument incorporating a microprocessor was constructed and tested to verify the accuracy of the theoretical procedures and error limits. Dissert. Abstr.

N79-29430 Virginia Univ., Charlottesville.
MILLIMETER WAVE RESPONSE OF NIOBIUM VARIABLE THICKNESS BRIDGES Ph.D. Thesis
Daniel Wayne Barr 1978 172 p
Avail: Univ. Microfilms Order No. 7916313

Niobium variable thickness bridges are fabricated on fused quartz and semiconducting substrates. Microwave mixing at 10 GHz with junctions on fused quartz substrates shows both Josephson and bolometric mixing effects. Joule heating is identified in the I-V relation by hysterysis and negative curvatures. Direct evidence of heating is observed in the dV/dI curves and forms the basis for a simple heating model. This model accounts for hysterysis and allows for the thermal properties of the junctions to be calculated. Heating effects are reduced in junctions fabricated on highly thermally conductive silicon and gallium arsenide substrates. A-C Josephson response to 100 GHz is observed in junctions on these semiconducting substrates; bolometric mixing effects are also seen. Dissert. Abstr.

N79-29431 Stanford Univ., Calif.
RELIABLE SYNCHRONIZATION AND MATCHING IN REDUNDANT SYSTEMS Ph.D. Thesis
Daniel Davies 1979 153 p
Avail: Univ. Microfilms Order No. 7917222

Concepts and terms useful in the study of synchronization and data matching in the presence of faults were identified and defined. A new class of faults having particular effect on redundant systems is described. A total of three general methods for performing synchronization and data matching are presented and evaluated. Applications which illustrate aspects of the general methods include the following: a fault tolerant clock, a triple modular redundant microcomputer system, and a quadruple redundant process controller. Dissert. Abstr.

N79-29432 Stanford Univ., Calif.
ON A PROBLEM OF CONTACT POTENTIAL BETWEEN TWO SOLID CYLINDERS Ph.D. Thesis
Martin Tygel 1979 101 p
Avail: Univ. Microfilms Order No. 7917286

A problem of classical potential theory suggested by the contact potential effect, without concern for molecular or microscopic aspects is examined. By means of a Fourier analysis an investigation of the properties of the density of the boundary distribution is carried out. Expression for that density is given in terms of one sided Fourier transforms of the potential on the upper and lower continuation of the composite cylinder. These transforms are characterized by means of a pair of integral equations of the second kind over a semi-infinite integral. Approximate solutions are given for the cases in which one of the cylinders, say the lower one, is semi-finite and when both cylinders which constitute B have the same length assumed much larger than the radius of B. Dissert. Abstr.

N79-29433*# RCA Solid State Div., Somerville, N.J.
ACCELERATED LIFE TESTING EFFECTS ON CMOS MICROCIRCUIT CHARACTERISTICS Technical Report, Nov. 1977 - Apr. 1979
Jun. 1979 16 p
(Contract NAS8-31905)
(NASA-CR-161282) Avail: NTIS HC A02/MF A01 CSCL 09C

Modifications and additions to the present process of making CMOS microcircuits which are designed to provide protective layers on the chip to guard against moisture and contaminants were investigated. High and low temperature Si3N4 protective layers were tested on the CMOS microcircuits and no conclusive improvements in device reliability characteristics were evidenced. R.E.S.

N79-29434# Rensselaer Polytechnic Inst., Troy, N. Y. Communication and Information Processing Group.
IMAGE ENHANCEMENT BY STOCHASTIC HOMOMORPHIC FILTERING
R. W. Fries and J. W. Modestino Feb. 1979 47 p refs
(Contract N00014-75-C-0281)
(AD-A068420; TR-79-2) Avail: NTIS HC A03/MF A01 CSCL 09/4

The problem of image enhancement by nonlinear two-dimensional (2-D) homomorphic filtering is approached using stochastic models of the signal and degradations. Homomorphic filtering has been used previously for image enhancement but the linear filtering operation has generally been chosen heuristically. In this paper stochastic image models described and analyzed previously by the authors are used to model the true image and interferring components (shadows and salt-and-pepper noise). The problem of designing the linear operation can then be formulated as one of linear least mean-squared error (Wiener) filtering. Examples of processing on typical real-world images are included to indicate the results obtainable. GRA

N79-29435# Varian Associates, Palo Alto, Calif.
STUDY OF RESONANT LOSS FOR HELIX TWTS Final Technical Report, 1 Sep. 1977 - 1 Sep. 1978
C. E. Hobrecht Mar. 1979 68 p refs
(Contract F30602-77-C-0172; AF Proj. 5573)
(AD-A068257; RADC-TR-79-35) Avail: NTIS HC A05/MF A01 CSCL 09/1

One of the most effective techniques for eliminating backward wave oscillations (BWOs) in helix type traveling wave tubes (TWTs) is resonant loss. The fundamental purpose of this program was to perform experimental work which would give a more complete understanding of the electrical and mechanical characteristics of this BWO suppression scheme. In order to accomplish this, the following data were obtained: resonant frequencies for a broad range of resonator geometries, resonator materials for high Q and high loss, frequency limits, achievable peak RF power levels for tubes using this scheme, in-band effects, frequency characteristics (Q), effects of asymmetric arrangements, power handling capability, and the effects of temperature and temperature cycling. Probably the most important conclusions are two: high power, PPM focused, conduction cooled helix TWTs using resonant loss for BWO suppression are no longer limited in achievable peak RF output power due to BWO and such tubes can, for the first time since their invention, be designed solely for the desired in-band RF performance. The latter conclusion is a direct result of the fact that the in-band effects of resonant loss are minimal. GRA

N79-29436# Purdue Research Foundation, Lafayette, Ind.
THE EFFECTS OF SUBSTRATE COMPOSITION ON THICK FILM CIRCUIT RELIABILITY Final Report, 1 Feb. 1978 - 31 Jan. 1979
R. W. Vest 28 Feb. 1979 92 p refs
(Contract N00019-78-C-0236)
(AD-A068220) Avail: NTIS HC A05/MF A01 CSCL 09/5

The saturation solubility of AlSiMag 614 (96% Al2O3) substrates in thick film resistor glass was determined as a function of temperature. These results were combined with dissolution rate studies in order to test various kinetic models. The viscosity of the resistor glass was measured as a function of amount of dissolved AlSiMag 614 substrate from the softening point to the annealing point of the glasses. The isothermal viscosity was found to increase by a factor of 20 with 10 w/o dissolved substrate relative to the standard lead borosilicate glass. The affects of the minor constitutients (4%) in the AlSiMag 614 substrate composition on viscosity and surface tension of the glasses was determined to be small. The sheet resistance, temperature dependence of resistance, and the current noise were measured for thick film resistors as a function of the amount of substrate dissolved in the resistor for various firing temperatures at constant firing time, and for various firing times at 800 C. Large variations in these three properties were observed, and the changes were qualitatively correlated with changes in viscosity of the glass. The microstructure development and charge transport models used to correlate the results indicate a retardation of microstructure development in the resistors as the amount of dissolved substrate increases. GRA

N79-29437# McDonnell-Douglas Astronautics Co., St. Louis, Mo.
INTEGRATED CIRCUIT ELECTROMAGNETIC SUSCEPTIBILITY INVESTIGATION, PHASE 3
J. M. Roe, J. R. Chott, T. W. Herron, C. N. Kohlberg, and C. E. Larson 5 Jan. 1979 98 p refs
(Contract N60921-76-C-A030)
(AD-A069052; MDC-E1998; NSWC/DL-TR-79-16) Avail:

NTIS HC A05/MF A01 CSCL 09/5

This report summarizes progress made in investigations into the RF susceptibility of integrated circuits (ICs). This report covers the work performed during the third of three increments. Included is a description of the revisions which were incorporated into the Integrated Circuit Electromagnetic Susceptibility Handbook (Report MDC E1929 dated 1 August 1978) which summarized all of the information obtained during the entire program in a handbook format for use by designers and EMC engineers. Results of tests of the susceptibilities of integrated circuits performed during this increment are described. Models of rectification in PN junctions developed during this increment are described. Simulations of interference effects in TTL NAND gates and 741 OP AMPs are included using computer-aided circuit analysis techniques and a modified Ebers-Moll transistor model which includes interference effects. Jitter effects due to RF interference in data transmission systems are discussed. This report includes a brief description of two Electromagnetic Susceptibility Seminars which were held during this increment. GRA

N79-29438# General Electric Co., Schenectady, N. Y.
INTERFACE DOPING OF MNOS TRANSISTORS Final Technical Report, 1 Apr. 1976 - 31 Mar. 1978
C. A. Neugebauer and M. M. Barnicle Jun. 1978 223 p refs
(Contract F33615-76-C-1035; AF Proj. 2305)
(AD-A068493; SRD-78-097; AFAL-TR-78-87) Avail: NTIS HC A10/MF A01 CSCL 09/1

The objective of this program is threefold: First to survey interface dopants suitable for use in MNOS nonvolatile storage transistors, to identify optimum dopant materials, concentrations, and deposition techniques, and to evaluate the write characteristics, retention, and endurance of interface doped MNOS devices by accelerated test methods. Second, to investigate the feasibility of fabricating n-channel interface doped MNOS transistors, both memory and stable gate and assess device yields. Third, to investigate their radiation hardness toward total dose ionizing radiation. GRA

N79-29439# Army Electronics Research and Development Command, Fort Monmouth, N. J. Electronics Technology/Devices Lab.
LIQUID ENCAPSULATED COMPOUNDING AND CZOCHRALSKI GROWTH OF SEMI-INSULATING GALLIUM ARSENIDE FOR MICROWAVE/MILLIMETER-WAVE APPLICATIONS
T. R. Aucoin, R. L. Ross, M. J. Wade, and R. O. Savage Jan. 1979 18 p refs
(DA Proj. 1L1-61102-AH-47)
(AD-A068203; DELET-TR-79-3) Avail: NTIS HC A02/MF A01 CSCL 20/12

A wide variety of semiconductor devices utilizing gallium arsenide are currently under development by the military for use in secure communication, improved surveillance, and high speed digital logic systems. The GaAs field effect transistor, a critical component in these systems, is experiencing a rapidly expanding use in oscillator, mixer, logic element, power amplification, and low-noise/high-gain applications. However, the full potential of this device has not been realized, partly because of poor and unpredictable quality semi-insulating GaAs substrates. More specifically, native defects, electrically active impurities, and diffusing charge traps are problems associated with commercial substrates. A silicon- and carbon-free modification of the liquid encapsulated Czochralski technique is described which yields high purity semi-insulating GaAs (approximately 10 to the 8th ohm-cm) without the intentional addition of charge compensators. The technique employs liquid encapsulated compounding of GaAs at nitrogen pressures to 100 atm, ultrapure elements, and pyrolytic boron nitride crucibles. A high pressure (135 atm) Varian HPCZ Czochralski crystal puller is employed for both compounding and crystal growth. Author (GRA)

N79-29440# Hughes Aircraft Co., Fullerton, Calif. Ground Systems Group.
EVALUATION OF ELECTRICAL GUARDBAND TESTING Final Technical Report, Jul. 1976 - Sep. 1977
Greg Allen, John Angus, and Bruce Clark Apr. 1979 85 p refs
(Contract F30602-76-C-0336)
(AD-A069161; RADC-TR-79-123) Avail: NTIS HC A05/MF A01 CSCL 14/2

Electrical guardband testing of microcircuits in lieu of 100% testing at the device temperature extremes has long been championed by device manufacturers as a cost effective means of guaranteeing reliable device performance in military systems. This report describes a detailed study of the validity of the guardbanding concept and the effects of manufacturer, datecode, and reliability grade upon these devices. Through the utilization of intensive testing techniques in conjunction with the development of a series of linear, log-linear, and exponential mathematical models a high degree of guardband test limit validity was established. Further analysis of the data utilizing advanced statistical techniques resulted in the development of a method for accurately setting guardband test limits on most parameters. Additional correlation analysis was performed on the test samples resulting in the establishment of the interchangeabiliy of JAN, 883B processed, and commerical devices. GRA

N79-29441# Texas Instruments, Inc., Dallas.
IC FABRICATION USING ELECTRON-BEAM TECHNOLOGY Quarterly Report, 1 Sep. - 1 Dec. 1978
Gilbert L. Varnell, Shang-Yi Chiang, and Jack Reynolds Apr. 1979 12 p
(Contract DAAB07-76-C-8105)
(AD-A068656; TI-03-79-01; DELET-TR-76-8105-9; QR-9) Avail: NTIS HC A02/MF A01 CSCL 09/5

A significant number (117) of 256-bit bipolar RAMs have been fabricated utilizing all e-beam direct slice writing and plasma etching. These devices pass all dc and ac electrical specifications including operating speed. A previous lot had device characteristics that were slower than specification due to an improper oxide thickness. One slice yielded 40% at dc probe compared to a high of 26% on one slice for a parallel photoresist lot. However, the lot yield for the e-beam slices was only 74% compared to 17% for the parallel photoresist lot. The reduced e-beam yield was attributed to an operator error during plasma etching of the contact O.R. and was not due to e-beam direct slice writing. Another lot of material is in progress (at metal) with tighter plasma etching control to complete the device quantity (500) required for completion of the contract. GRA

N79-29442# Rome Air Development Center, Griffiss AFB, N.Y.
A DESIGN GUIDE FOR BUILT-IN TEST (BIT)
Anthony Coppola Apr. 1979 124 p refs
(AF Proj. 2338)
(AD-A069384; RADC-TR-78-224) Avail: NTIS HC A06/MF A01 CSCL 14/2

This report summarizes available information of use in designing built-in-test (BIT) capabilities in electronic systems. It describes the various types of BIT, design considerations and examples, data used in BIT design, display options, coupling and shielding considerations, and optimization models. GRA

N79-29443# Sandia Labs., Albuquerque, N. Mex.
RADIATION INDUCED FREQUENCY AND RESISTANCE CHANGES IN ELECTROLYZED HIGH PURITY QUARTZ RESONATORS
T. J. Young, D. R. Koehler, and R. A. Adams Sep. 1978 27 p
(SAND-78-0102) Avail: NTIS HC A03/MF A01

A description is given of the radiation measurement methods, transient and steady-state data, and the results of thermal modeling. It is concluded that SARP optical and Premium-Q quartz may be pure enough as grown that (1) the usual frequency time dependent recovery characteristics of t/sup-1/ 2/ is not observed; (2) without electrolysis, the impurity levels are nevertheless high enough to cause a significant decrease in Q for a short time following a pulse of ionizing radiation; (3) electrolysis can further reduce radiation response so that impurity effects are no longer significant; and (4) the transient radiation response in electrolyzed quartz is primarily thermal in nature. DOE

N79-29444# Los Alamos Scientific Lab., N. Mex.
COMPUTER PROGRAMS FOR THE AUTOMATIC PLACEMENT OF INTEGRATED CIRCUITS
J. D. Richman Mar. 1979 24 p refs

(Contract W-7405-eng-36)
(LA-7652-MS) Avail: NTIS HC A02/MF A01

Two computer programs, based on different algorithms, were developed for the automatic placement of integrated circuits (chips) on UNIVERSAL cards and CASH cards. The algorithms use elementary ideas of graph theory to construct a placement of the chips. The merit of the placement is measured by a quantity approximating the average length per wire. The better of the two programs placed 106 chips on CASH cards in 13 s of computer time, with an average of 2.9 in. per wire. The theory for the two algorithms and detailed information for the use of the programs is presented. DOE

N79-29445# McElroy (Ralph) Co., Austin, Tex.
ELECTROREGENERATION OF CHROMIC ACID ON A LEAD DIOXIDE ANODE
E. A. Czhafarov and F. G. Bairamov Dec. 1978 12 p refs Transl. into ENGLISH from the book "Issledovaniya v Oblasti Neorganicheskoi i Fizicheskoi Khimii" Baku, Elm Press, 1970 p 375-384
(ANL-Trans-1159) Avail: NTIS HC A02/MF A01

The electrooxidation of chromic sulfate to chromic acid on a PBO2 anode produced by electroprecipitation onto a graphite base from a nitrate electrolyte was investigated. Optimum conditions were determined to be: CR2(SO4)3, 5H2O, 300 g/1; H2SO4, 50 to 100 g/1; anode current density, 10 to 20 A/sq dm, and temperature 50 to 60 C. Current efficiency is approximately 90%. The mechanism is direct electrooxidation of Cr(3+) ions to chromate ions. DOE

N79-29446# Fondazione Ugo Bordoni, Rome (Italy).
APPLICATIONS OF THE WIENER OPTIMAL FILTER THEORY TO THE CHARACTERIZATION OF AN EQUALIZER FOR DATA TRANSMISSION IN COAXIAL CABLES [APPLICAZIONE DEL FILTRO OTTIMO DI WEINER PER L'IDENTIFICAZIONE DI UN EQUALIZZATORE PER COLLEGAMENTI NUMERICI IN CAVE COASSIALE]
Luigi Giacomelli (Ancoma Univ., Italy), Renato Lucarelli, and Aldo Rover (Rome Univ.) Aug. 1977 19 p refs In ITALIAN
(FUB-28-1977) Avail: NTIS HC A02/MF A01

A computing procedure based on the Wiener optimal filter is described in order to characterize a transfer function for a random type equalization network. The program can be used with different types of line codes and a given noise level at the equalizer inlet. The program was tested for a variety of conditions and one case is presented in detail. Results show that the amplitude and phase characteristics can be obtained for a random transfer function for an equalizing network of a purely regenerative data transmission system. Author (ESA)

N79-29447# Fondazione Ugo Bordoni, Rome (Italy).
DESIGN PHILOSOPHY FOR FUTURE DIGITAL INTEGRATED NETWORKS
Roberto Montemurro and Francesco Villani 1978 8 p refs Presented at 3rd Intern. Symp. on Subscriber Loops and Serv., Atlanta, Mar. 1978
(FUB-33-1977) Avail: NTIS HC A02/MF A01

A possible configuration for completely digital local telephony networks is described. Digital subscriber's terminals, distributed switching and control, and a flexible network topology are the main distinctive features of the envisaged system. A full digitalization is considered neccesary in order to solve the problem of increasing costs of local telephone networks. The progressive steps in digitalization and several aspects of network configuration are discussed. Author (ESA)

N79-29448# Plessey Co. Ltd., Romsey (England).
COMPONENT MODELLING OF MICROWAVE TRANSISTORS Final Report
R. D. Mount, L. G. T. Hopkins, P. D. Cooper, and S. J. Hewitt Paris ESA Jul. 1977 73 p refs
(Contract ESA-2733/76-NL-AK(SC))
(Rept-72/77/93; ESA-CR(P)-1170) Avail: NTIS HC A04/MF A01

Work undertaken to provide nonlinear equivalent circuits for microwave transistors, suitable for use in the IMAG-3 analysis program operated by ESTEC, is described. The work program included selection of suitable equivalent circuits, measurement of the circuit parameters, and experimental validation. Five different types of microwave transistors were characterized. In each case an experimental amplifier stage was constructed and its performance compared with the results of nonlinear analysis. MODEL and TYPE descriptions of these transistors were prepared for use in the IMAG-3 program. Author (ESA)

N79-29449# Fondazione Ugo Bordoni, Rome (Italy).
AN IMPROVED METHOD FOR MEASURING THE COMPLEX PERMITTIVITY OF LOSSY DIELECTRICS AT MILLIMETER WAVE FREQUENCIES
Franco Bertolani, Gabriele Falciasecca (Bologne Univ.), and Vittorio Rizzoli (Bologne Univ.) Jun. 1978 6 p refs Presented at 8th European Microwave Conf., Paris, 1978 Sponsored partly by Ital. Natl. Res. Council (CNR)
(FUB-12-1978) Avail: NTIS HC A02/MF A01

An accurate knowledge of the complex permittivity of dielectric materials is of importance at millimeter-wave frequencies for a number of applications. Since conventional lower-frequency techniques are not of use above 30 GHz, a special method for measuring such parameters was developed. The essential features of the method are the use of a TE sub 01 -mode resonant cavity, which virtually eliminates the effects of any thin air gap separating the dielectric sample from the waveguide walls, and the evaluation of the loaded Q factors by a spectral-domain technique yielding unexecelled resolution and accuracy in determining the loss tangent even of low-loss dielectrics.
Author (ESA)

N79-29450# Laboratoires d'Electronique et de Physique Appliquee, Limeil-Brevannes (France).
GROWTH OF 3-5 COMPOUNDS FOR SEMICONDUCTOR DEVICES BY THE ORGANOMETALLIC METHOD Final Report [CROISSANCE DE COMPOSES]
J. Hallais and J. P. Andre Feb. 1978 68 p refs In FRENCH
(Contract DGRST-76-7-0671)
(LEP-78/199.SME-555-A) Avail: NTIS HC A04/MF A01

An organometallic method was applied to the epitaxial growth of GaAs and GaAs - GaAlAs heterostructures in order to investigate the application of the method to industrial needs. Crystal layers were grown, characterized, and used in the construction of FET devices. Results show the method to be comparable with conventional vapor or liquid phase techniques, but no superiority could be demonstrated. Possible applications of these crystals in various semiconductor devices are discussed. The main drawback of this method lies on the residual doping of GaAs manufacture of multilayer materials for GaAs - (Ga, Al)As heterojunctions. Author (ESA)

N79-29451# Laboratoires d'Electronique et de Physique Appliquee, Limeil-Brevannes (France).
PRELIMINARY STUDY OF A SUPERHIGH FREQUENCY INTEGRATED FRONT-END ON A GaAs SEMICONDUCTOR USING FET [PRE-ETUDE DE TETE H.F. INTEGREE SUR LE GaAs SEMI-ISOLANT UTILISANT DES FETS]
John Magarshack, Rene Dessert, and Peter Harop Apr. 1978 76 p refs In FRENCH
(Contract DGRST-76-7-0693)
(LEP-78/519-679-D) Avail: NTIS HC A04/MF A01

Equivalent schematics illustrating the application of the field effect transistor to the mixing and oscillating functions of a receiver were theoretically studied in order to determine the optimal circuit characterized by gain of conversion. Different types of nonlinearity, elbow of the characteristic I sub D/V sub g, saturation of the characteristic I sub D/V sub D, and the conjugant modulation of these characteristics were experimentally investigated using test circuits. Using results obtained, a mixer and oscillator were built, then combined to assemble a television receiver front-end. This assembly is shown to have superior performance characteristics vis a vis conventional receivers. Details of the circuit characteristics are presented in an appendix.
Author (ESA)

N79-29452# Research Inst. of National Defence, Stockholm (Sweden).
EXPERIMENTAL DETERMINATION OF TRANSIENT VOLTAGES IN A COIL [EXPERIMENTELL BESTAEMMING AV TRANSIENTA SPAENNINGAR I EN SPOLE]

Torbjoern Karlsson and Sven Persson May 1978 22 p refs In SWAHILI
(FOA-C-30140-A3) Avail: NTIS HC A02/MF A01

The voltage induced in a coil by a pulse transient field was measured in order to quantify the reduction in amplitude and increase in pulse width derived from the differences in the induction field between coil winds. The voltages between the various winds of a coil were recorded by an oscilloscope and photographed so that the different wave forms could be compared. Results show that induced voltage is not proportional to the number of winds in the coil. A qualitative explanation is presented. Author (ESA)

N79-29453# Bureau of Radiological Health, Rockville, Md. Div. of Compliance.
X-RADIATION AND IDENTIFICATION CHARACTERISTICS OF CRT'S OF FOREIGN MANUFACTURE Final Report
Feb. 1979 80 p
(PB-293459/4; DHEW/PUB/FDA-79/8081; FDA/BRH-79/69)
Avail: NTIS HC A05/MF A01 CSCL 09A

The labeling and identification of television cathode ray tubes (CRT's) is discussed so that the radiation safety of products using them can be maintained. The information is grouped by manufacturer and type of display. The selling model or type numbers are then listed in order of increasing CRT size. For a given CRT size, different type numbers would have equivalent radiation characteristics when the registration reference voltage is the same. Rebuilt CRT's are to be labeled with the same original type number or with a type number of the same size that has the same radiation specifications. The same radiation specifications are shown in the tables whenever original identification is missing, the CRT's of a given size can only be relabeled with a type number that has the same glass identification markings. GRA

N79-29454# National Bureau of Standards, Washington, D. C. National Engineering Lab.
CMOS/SOS TEST PATTERNS FOR PROCESS EVALUATION AND CONTROL Annual Report, 1 Mar. - 1 Nov. 1978
Loren W. Linholm 1 Jan. 1979 52 p refs Sponsored in part by the Air Force
(PB-293487/5; NBSIR-79-1595) Avail: NTIS HC A04/MF A01 CSCL 09E

The National Bureau of Standards in collaboration with the Jet Propulsion Laboratory, Pasadena, CA and RCA, Somerville, NJ, has designed a CMOS/SOS test pattern, NBS-16, and the necessary measurement techniques. The NBS-16 test pattern was designed, a pattern generator tape was designed, a pattern generator tape was delivered to RCA, and the testing hardware and software was developed. A program schedule and a description and illustration of each test structure are presented. GRA

34 FLUID MECHANICS AND HEAT TRANSFER

Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.

For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics.*

N79-29455 British Library Lending Div., Boston Spa (England).
ACOUSTIC PULSATIONS AND VIBRATORY STRESSES IN HEAT EXCHANGERS
A. Jaudet and D. Huetzler [1978] 27 p refs Transl. into ENGLISH from report by Inst. Francais des Combustibles et de l'Energie 27 p
(BLL-Windscale-657-(9091.9F)) Copyright. Avail: British Library Lending Div., Boston Spa, Engl.

The flow of a heat-bearing fluid in a heat exchanger causes the loosening of nonstreamlined obstacles which it encounters. The effect is simultaneous production of a mechanical excitation of these obstacles and generation of fluctuations of pressure downstream from them. Pressure pulsations generated by obstacles are not greatly influenced by mechanical vibrations of the obstacles so long as the amplitude of such vibrations remains low. On the other hand, the proximity of partitions and concidences with acoustic resonances sometimes impose a synchronization of pulsations and consequently an increase in amplitude. These acoustic pulsations are propagated in the flow and create mechanical vibrations on the sides of the exchanger. These vibrations may in some cases reach substantial magnitude at points far removed from the obstacles constituting the source of excitation. G.Y.

N79-29456 Washington Univ., Seattle.
TOPOGRAPHIC FORCING OF THERMAL CONVECTION IN A HELE-SHAW CELL MODEL OF A POROUS MEDIUM Ph.D. Thesis
Beverly Karplus Hartline 1978 196 p
Avail: Univ. Microfilms Order No. 7917575

Topographic forcing of porous convection was investigated by modifying the Hele-Shaw cell to have a sinusoidally contoured, isothermal upper boundary. Eight different topographies with nondimensional wavenumbers between 1.43 and 8.17 were employed. The amplitude of each topography tapers linearly (over a factor of three to six) from one end of the apparatus to the other, and the mean topographic amplitude is 0.05 to 0.08 times the average depth of the layer. These experiments reveal two different flow regimes: subcritical flow occurs when the Rayleigh number is less than the critical Rayleigh number for a layer with flat boundaries, while supercritical flow develops at higher Rayleigh numbers. Dissert. Abstr.

N79-29457 Ohio Univ., Athens.
SEMI-PREDICTIVE CONTROL OF A HEAT EXCHANGER Ph.D. Thesis
Troy Gaspard Mounce 1979 176 p
Avail: Univ. Microfilms Order No. 7918041

The various types of disturbances presented are recognized and a different optimum corrective action taken for each with computer control. All actions must be taken based on measurements of the process output only. Dissert. Abstr.

N79-29458 Oregon State Univ., Corvallis.
HEAT TRANSFER TO HORIZONTAL TUBES IN FLUIDIZED BEDS: EXPERIMENT AND THEORY Ph.D. Thesis
Nikola Milivoj Catipovic 1979 242 p
Avail: Univ. Microfilms Order No. 7917866

A theoretical model, applicable over a wide range of fluidizing conditions in bubbling and slugging beds, is proposed. The theory assumes that heat exchange between a cold fluidized bed and a horizontal tube takes place by three parallel paths-heat is transferred by packets of particles, by gas percolating between the particles and the tube surface, and by gas bubbles or slugs. Correlations are presented for the corresponding particle convective, gas convective, and bubble heat transfer coefficients, as well as for the voidage around the tube. An analysis shows that, from a heat transfer standpoint, particles may be classified as fine, intermediate, and large. For each of these cases, equations for the time-averaged heat transfer coefficient to the tube as a whole are given. The model is introduced for the conductive and convective modes of heat transfer. Dissert. Abstr.

N79-29459 New Jersey Inst. of Technology, Newark.
INTERACTION BETWEEN STRUCTURES AND FLUIDS Ph.D. Thesis
Rahim Falsafi-Haghighi 1978 183 p
Avail: Univ. Microfilms Order No. 7902978

A finite element model for the study of solid-fluid interaction, with applications in flow-induced vibration analysis of reactor vessel and heat exchanger internals, is presented. Plane triangular finite elements for fluid, solid and solid-fluid continua and equivalent mass, damping and stiffness matrices and interaction load array were developed for the study of wave propagation phemonena in a two-dimensional flow field. This is verified by solving a wave propagation flow problem consisting of water, between two elastic parallel plates, initially at rest and accelerated suddenly by applying a step pressure at one end. Dissert. Abstr.

N79-29460 Michigan State Univ., East Lansing.
AN EXPERIMENTAL STUDY OF THE TRANSPORT OF A NON-DIFFUSIVE SCALAR CONTAMINANT IN THE DECAYING TURBULENCE FIELD OF AN ENCLOSED

CHAMBER Ph.D. Thesis
Kenneth Charles Cornelius 1978 155 p
Avail: Univ. Microfilms Order No. 7917688

An experimental investigation of the convective properties of a turbulence field within a closed mixing chamber was executed; the investigation is supported by appropriate theoretical analyses. Dissert. Abstr.

N79-29461 Rochester Univ., N. Y.
THE STABILITY AND GROWTH OF TURBULENT TEMPERATURE STRATIFIED PARALLEL FREE SHEAR LAYERS AND THE STABILITY OF TURBULENT CYLINDRICAL COUETTE FLOW Ph.D. Thesis
Thomas Edward Butler 1979 140 p
Avail: Univ. Microfilms Order No. 7914462

The stability of a temperature stratified parallel free shear layer is examined. The mean velocity and mean density profiles are approximated by hyperbolic tangent functions and the perturbation equations are integrated numerically. The assumption that the shear layer stays marginally stable as it grows is used to calculate the shear layer width as a function of time. The stability of turbulent Couette flow between a fixed outer cylinder and a concentric rotating cylinder is investigated. An exponential form is used to approximate the moment of mean velocity in the boundary layers near each cylinder. Dissert. Abstr.

N79-29462 Minnesota Univ., Minneapolis.
THE SHAPE AND STABILITY OF THREE-DIMENSIONAL INTERFACES Ph.D. Thesis
Robert Arthur Brown 1979 362 p
Avail: Univ. Microfilms Order No. 7918320

Computer-aided analysis by the finite element method is used to study the shape and stability of interfaces with appreciable surface tension. The fluids surrounding the interfaces are static and the shapes of the interfaces are three-dimensional. Finite element analysis is used to study the shape, stability, and bifurcation of rotating liquid drops. The shape and stability of a rotating liquid drop held captive between two circular rotating faces are studied. When the drop volume is close to that of the cylinder, the rotating captive drop models the shape of the melt in the float zone process of growing single crystal metals. Element analysis uncovers the previously known axisymmetric shapes and new two-, three-, and four-lobed shapes. The stabilities of these shapes with respect to both angular-momentum-conserving (free drop) and angular-velocity-conserving (forced drop) perturbations are found. Dissert. Abstr.

N79-29463 Tennessee Univ., Knoxville.
A GENERALIZED BASE-FLOW ANALYSIS WITH INITIAL BOUNDARY-LAYER AND CHEMISTRY EFFECTS Ph.D. Thesis
John Howard Fox 1979 119 p
Avail: Univ. Microfilms Order No. 7918633

A general theory was developed for the supersonic, turbulent, near-wake region behind bluff-based, two dimensional and axially symmetric bodies in the presence of a coaxial, supersonic jet. The effects of the initial boundary layer, base bleed, total enthalpy and species differences, and equilibrium chemistry are included. The generalization was accomplished through the development of an analytical recompression model that obviates the requirement for a recompression factor; the development of a species distribution model for the mixing layers; and the use of a new spreading parameter for the axially symmetric problem. Good agreement is shown with experiment for the classical, planar-backstep problem with both thin and very thick boundary layers as well as with base flows behind axially symmetric bodies with a coaxial jet. Dissert. Abstr.

N79-29464 Minnesota Univ., Minneapolis.
FLUID MICROSTRUCTURE: COLD STAGE ELECTRON MICROSCOPY AND THEORETICAL MODELLING Ph.D. Thesis
Yeshayahu Talmon 1979 259 p
Avail: Univ. Microfilms Order No. 7918399

A fast-freeze cold stage technique for examination of microstructured liquids in the transmission electron microscope is described. A thin layer of liquid is trapped between two thin polymer films, quick-frozen in liquid nitrogen at its melting point, and transferred by a specially designed transfer module to a newly adapted cold stage for the electron microscope. Details are presented of sample preparation, transfer of frozen samples to the microscope, and special equipment developed for these purposes. Dissert. Abstr.

N79-29465 Princeton Univ., N. J.
FREE JET DECELERATION: A SCHEME FOR SEPARATION OF GAS SPECIES OF DISPARATE MASS Ph.D. Thesis
Thuan Ke Nguyen 1979 122 p
Avail: Univ. Microfilms Order No. 7918563

A gasdynamic separation scheme displaying large separation factors is described. Deceleration of the heavy species in a seeded supersonic free jet by a background of stagnant carrier gas to produce velocity disequilibrium among the heavy species is employed. Separation is achieved by means of a capillary membrane placed normal to the flow. The greater velocity persistence a species has, the greater is its flux through the membrane. The heavy species are split into a light and a heavy cut. The operation of this device is analyzed in terms of a theoretical model, and predictions of the model are verified by isotope enrichment experiments in which Kr86/KR82 and Xe132/Xe129 enrichments are measured using He as the carrier. Dissert. Abstr.

N79-29466*# Mississippi State Univ., Mississippi State.
NUMERICAL SOLUTION OF THE NAVIER-STOKES EQUATIONS FOR LAMINAR, TRANSONIC FLOWS Ph.D. Thesis
Louie Turner, III May 1979 148 p refs
(Grant NGR-25-001-055)
(NASA-CR-158869) Avail: NTIS HC A07/MF A01 CSCL 20D

An implicit finite difference solution of the Navier-Stokes equations yielded time histories of the transonic laminar flow development about a circular cylinder and NACA-0018 airfoil. Reynolds numbers ranged from those corresponding to purely laminar flow to those corresponding to significant turbulence in the boundary layer. Body thermal conditions of an adiabatic wall and a specified body temperature were considered. Versatility in treating arbitrary bodies was incorporated by using numerically generated, body-fitted coordinate transformations. Solution of the simultaneous difference equations for the dependent variables was obtained using an accelerated Gauss-Seidel iterative scheme. Computational results are presented in the form of velocity vector fields, Mach number contours, aerodynamic coefficients, heat transfer rates at the body surface, and body temperature distributions. Truncation analyses of first and second derivative difference approximations resulted in general criteria for numerically generated coordinates so that flow near a body is more accurately represented. K.L.

N79-29467*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CONTOURED TANK OUTLETS FOR DRAINING OF CYLINDRICAL TANKS IN LOW-GRAVITY ENVIRONMENT
Eugene P. Symons Jul. 1979 45 p
(NASA-TP-1492; E-9969) Avail: NTIS HC A03/MF A01 CSCL 20D

An analysis is presented for defining the outlet contour of a hemispherical-bottomed cylindrical tank that will prevent vapor ingestion when the tank is drained. The analysis was used to design two small-scale tanks that were fabricated and then tested in a low gravity environment. The draining performance of the tanks was compared with that for a tank with a conventional outlet having a constant circular cross-sectional area, under identical conditions. Even when drained at off-design conditions, the contoured tank had less liquid residuals at vapor ingestion than the conventional outlet tank. Effects of outflow rate, gravitational environment, and fluid properties on the outlet contour are discussed. Two potential applications of outlet contouring are also presented and discussed. K.L.

N79-29468*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
TWO-PHASE CHOKED FLOW OF CRYOGENIC FLUIDS IN CONVERGING-DIVERGING NOZZLES
Robert J. Simoneau and Robert C. Hendricks Jul. 1979 83 p refs

(NASA-TP-1484; E-9659) Avail: NTIS HC A05/MF A01 CSCL 20D

Data are presented for the two phase choked flow of three cryogenic fluids - nitrogen, methane, and hydrogen - in four converging-diverging nozzles. The data cover a range of inlet stagnation conditions, all single phase, from well below to well above the thermodynamic critical conditions. In almost all cases the nozzle throat conditions were two phase. The results indicate that the choked flow rates were not very sensitive to nozzle geometry. However, the axial pressure profiles, especially the throat pressure and the point of vaporization, were very sensitive to both nozzle geometry and operating conditions. A modified Henry-Fauske model correlated all the choked flow rate data to within + or - 10 percent. Neither the equilibrium model nor the Henry-Fauske model predicted throat pressures well over the whole range of data. Above the thermodynamic critical temperature the homogeneous equilibrium model was preferred for both flow rate and pressure ratio. The data of the three fluids could be normalized by the principle of corresponding states. K.L.

N79-29469*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

A GROUP-VELOCITY CRITERION FOR BREAKDOWN OF VORTEX FLOW: AN APPLICATION TO MEASURED INLET PROFILES

Chon-Yin Tsai and Sheila E. Widnall (MIT, Cambridge, Mass.) Jul. 1979 39 p refs

(NASA-TM-78542; A-7668) Avail: NTIS HC A03/MF A01 CSCL 20D

Vortex flows exhibiting breakdown in a slightly divergent duct were measured. The slowly varying vortex flow field downstream of the entrance and upstream of the breakdown region is obtained numerically by using the inviscid quasi-cylindrical approximation. In these calculations, the Faler and Lebovich's experimental data were used as the starting conditions at the entrance of the duct. The group velocity of wave propagation for the axisymmetric mode (n = 0) and the asymmetric modes (n = + or - 1 and n = + or - 2) are calculated for the entrance conditions. For the theoretically predicted slowly varying flow field downstream of the entrance, the wave characteristics of the n = 0 and n = + or - 1 modes are presented. It was concluded that the flows which subsequently undergo vortex breakdown are all predicted to be supercritical and stable to infinitesimal inviscid disturbances, including the axially symmetric as well as the nonsymmetric perturbations. M.M.M.

N79-29470*# McDonnell-Douglas Astronautics Co., St. Louis, Mo.

THERMOSTRUCTURAL APPLICATIONS OF HEAT PIPES Final Report

M. E. Peeples, J. C. Reeder, and K. E. Sontag Jun. 1979 127 p refs

(Contract NAS1-15554)

(NASA-CR-159096) Avail: NTIS HC A07/MF A01 CSCL 20D

The feasibility of integrating heat pipes in high temperature structure to reduce local hot spot temperature was evaluated for a variety of hypersonic aerospace vehicles. From an initial list of twenty-two potential applications, the single stage to orbit wing leading edge showed the greatest promise and was selected for preliminary design of an integrated heat pipe thermostructural system. The design consisted of a Hastelloy X assembly with sodium heat pipe passages aligned normal to the wing leading edge. A d-shaped heat pipe cross section was determined to be optimum from the standpoint of structural weight. Author

N79-29471*# California Univ., San Diego, La Jolla. Dept. of Applied Mechanics and Engineering Sciences.

FURTHER RESULTS RELATED TO THE TURBULENT BOUNDARY LAYER WITH SLOT INJECTION OF HELIUM

John C. LaRue and Paul A. Libby [1978] 21 p refs

(Grants NsG-1386; NsG-3219)

(NASA-CR-157450) Avail: NTIS HC A02/MF A01 CSCL 20D

Data from an experiment involving the slot injection of helium into a turbulent boundary layer in air are analyzed in terms of unconditioned and conditioned Favre-averages. The conditioning is based on two levels of helium concentration so that the contributions to the unconditioned statistics from air, helium, and mixture of these two gases can be determined. The distributions of intermittency associated with the two helium levels establish the domains of influence of air, helium, and mixture. Author

N79-29472# Weapons Systems Research Lab., Salisbury (Australia).

AN ATTEMPTED EXTENSION OF A FINITE SOLUTION TO AXISYMMETRIC POTENTIAL FLOW

M. K. Haselgrove Nov. 1978 21 p refs

(WSRL-0056-TR; AR-001-422) Avail: NTIS HC A02/MF A01

A Galerkin finite element method was applied to axisymmetric potential flow. Solutions were sought for three alternative formulations using different representations for the velocity components. A.W.H.

N79-29473# Grumman Aerospace Corp., Bethpage, N.Y.

TURBULENT FLOWS PRODUCED BY PERFORATED PLATE GENERATORS IN WIND TUNNELS

Barry Gilbert 11 Aug. 1978 18 p refs Backup document for AIAA Synoptic scheduled for publication in AIAA Journal in Jan. 1980

(Log-J10987) Avail: NTIS HC A02/MF A01

An application of perforated sheet metal plates was shown to provide an efficient method of producing a large range of turbulent flows for experimental investigation. Fabrication of a standard uniformly perforated grid was done quickly, with ordinary machine shop equipment. Different flow geometries were produced acurately without the use of special equipment. The standard grid and two geometric variations were investigated giving isotropic flow, wake flow, and uniform shear flow. Although the degree of isotropy was excellent, the variation in mean velocity profiles was slightly poorer than found for other grid generators. The wake and shear flows were comparable in quality to similar flows produced experimentally by other methods. Author

N79-29474*# B & K Engineering, Inc., Towson, Md.

ADVANCED THERMAL CONTROL FLIGHT EXPERIMENT (ATFE) Final Report

30 Jul. 1979 61 p refs

(NASA Order A-33703-B)

(NASA-CR-152305; BK028-1001) Avail: NTIS HC A04/MF A01 CSCL 20D

A comprehensive description of the design and performance of the Advanced Thermal Control Flight Experiment (ATFE) is presented. The ATFE studied in a space environment for five years the steady state, transient ground and flight performance of (1) a thermal diode heat pipe, (2) a phase change material, and (3) a feedback controlled variable conductance heat pipe. It was found that all were flight worthy and highly reliable. R.E.S.

N79-29475# Johns Hopkins Univ., Baltimore, Md. Dept. of Mechanics and Materials Science.

STABILITY AND BIFURCATION OF UNSTEADY FLOWS Final Report

Stephen H. Davis Apr. 1979 6 p refs

(Grant DAAG29-78-G-0103)

(AD-A068445; ARO-15720.1-M) Avail: NTIS HC A02/MF A01 CSCL 20/4

The work described herein concerns the determination of stability characteristics for time-dependent states of fluid flows or ordinary and partial differential equations in general. In particular nonlinear theories and simulations of bifurcation and stability are examined using energy methods, multiple-scale techniques and numerical procedures. GRA

N79-29476# Purdue Univ., Lafayette, Ind. School of Mechanical Engineering.

LASER VELOCIMETER MEASUREMENTS IN TURBULENT AND MIXING FLOWS Interim Report, 1 Mar. 1977 - 30 Sep. 1978

Warren H. Stevenson and H. Doyle Thompson Mar. 1979 25 p refs

(Contract F33615-77-C-2010; AF Proj. 2308)

(AD-A068256; AFAPL-TR-79-2009) Avail: NTIS

HC A02/MF A01 CSCL 20/4

An experimental facility has been designed and constructed to investigate the application of laser Doppler velocimetry to turbulent and mixing flows. Major features of the optical system include variable fringe spacing, variable beam diameter in the probe volume, precise control of the beam intersection point relative to the beam waist, provision for frequency shifting of one or both input beams, the ability to easily rotate the instrument about the optical axis, the ability to traverse the probe volume in x, y and z, and the control of the polarization of light entering the beam divider. The flow system provides subsonic air flow over a rearward facing step simulating a dump combustor. The data collection and storage system consists of a high speed burst processor, a dedicated microcomputer for high speed data collection, and a floppy disc for data storage. Data processing is done on a CDC6500 computer connected to the system via a phone line. The system will be used to measure and document measuring biases in an LDV system in highly turbulent and mixing flows. GRA

N79-29477# Wisconsin Univ. - Madison. Mathematics Research Center.

MONOTONE DIFFERENCE APPROXIMATIONS FOR SCALAR CONSERVATION LAWS

Michael G. Crandall and Andrew Majda Feb. 1979 20 p refs

(Contract DAAG29-75-C-0024)

(AD-A068905; MRC-TSR-1922) Avail: NTIS HC A02/MF A01 CSCL 20/4

A complete self-contained treatment of the stability and convergence properties of conservation form, monotone difference approximations to scalar conservation laws in several space variables is developed. In particular, the authors prove that general monotone difference schemes always converge and that they converge to the physical weak solution satisfying the entropy condition. Rigorous convergence results follow for dimensional splitting algorithms when each step is approximated by a monotone difference scheme. The results are general enough to include, for instance, Godunov's scheme, the upwind scheme (differenced through stagnation points), and the Lax-Friedrichs scheme together with appropriate multi-dimensional generalizations. GRA

N79-29478# Wisconsin Univ. - Madison. Mathematics Research Center.

GALERKIN METHODS FOR MISCIBLE DISPLACEMENT PROBLEMS IN POROUS MEDIA

Richard E. Ewing and Mary Fanett Wheeler Mar. 1979 26 p refs

(Contract DAAG29-75-C-0024; Grants DAAG29-78-G-0161; NSF MCS-78-09525; NSF MCS-78-00913)

(AD-A068943; MRC-TSR-1932) Avail: NTIS HC A03/MF A01 CSCL 20/4

A priori error estimates for Galerkin methods for numerical approximation of the coupled quasilinear system for c - c(x,t) and p - p(x,t) and appropriate Neumann boundary and initial conditions are considered. Equations of this type arise in models for the miscible displacement of one incompressible fluid by another in a porous medium. Estimates for both continuous time and fully-discrete time Galerkin methods are presented. GRA

N79-29479# ARO, Inc., Arnold Air Force Station, Tenn.

HEAT TRANSFER, SURFACE PRESSURE, AND BOUNDARY-LAYER TRIPS AT MACH 6, PHASE 2 Final Report

Frederick K. Hube AEDC Jul. 1978 72 p refs

(AD-A068540; AEDC-TSR-78-V25) Avail: NTIS HC A04/MF A01 CSCL 20/4

Heat transfer, surface pressure, and boundary-layer surveys were obtained on a 7-deg cone as well as 10.5/7 deg and 14/7-deg biconic bodies. These data were obtained to determine the influence of boundary-layer trips on boundary-layer characteristics when compared with a naturally turbulent boundary layer. Flow field measurements included pitot-pressure, total temperature, and Preston tube data. Surveys were performed at several longitudinal stations along the bodies. Boundary-layer trips consisted of Carborundum grit bonded to the nose tips or a single row of spherical elements. Data were obtained at a nominal Mach number of 6 at free-stream Reynolds numbers of 2,5000,000 and 4,700,000 per ft. A variety of nose bluntness and trip combinations were tested at zero angle of attack. GRA

N79-29480# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).

EFFECTS OF A TURBULENT FREE STREAM AND A WALL ROUGHNESS ON THE FLOW NORMAL TO A CYLINDER AT SUBCRITICAL REYNOLDS NUMBERS Final Report

Mark Moeller and D. Olivari Jun. 1978 74 p refs

(Grant AF-AFOSR-3584-78; AF Proj. 2301)

(AD-A069112; VKI-1978-24; EOARD-TR-79-2) Avail: NTIS HC A04/MF A01 CSCL 20/4

The flow normal to a circular cylinder at subcritical Reynold's Numbers was investigated to determine the feasibility of using subcritical Reynold's Number model tests to determine supercritical behavior. This finds application in the area of predicting wind loads on structures with circular cross-sections such as chimneys and cooling towers. The measurements were made in the VKI's L2A low speed wind tunnel. The measurements include static pressure, r.m.s. pressure fluctuation, wall shear stress, and velocity profiles at 90 deg. The r.m.s. pressure fluctuations were measured with a flush mounted Kulite probe. The wall shear stress was measured by a flush mounted hot film probe. The velocity profiles were measured with a wire anemometer. Also velocity measurements were made at 1/2mm, 1mm, and 2mm from the surface of the cylinder with flush mounted hot wires. The cylinder was rotated to generate the velocity at a fixed height from the cylinder as a function of the angle to the freestream. The smooth cylinder in the quiet freestream exhibited behavior consistent with the data found in the literature. Both the smooth cylinder in the turbulent freestream and the rough cylinder in the quiet freestream showed some of the characteristics of a cylinder at supercritical Reynold's Numbers. GRA

N79-29481# Wisconsin Univ. - Madison.

ON THE SWIRLING FLOW BETWEEN ROTATING COAXIAL DISKS, ASYMPTOTIC BEHAVIOR, 1 Technical Summary Report

Heinz Otto Kreiss and Seymour V. Parter Mar. 1979 31 p refs

(Contracts DAAG29-75-C-0024; N00014-76-C-0341)

(AD-A069285; CSTR-347; MRC-TSR-1941) Avail: NTIS HC A03/MF A01 CSCL 20/4

Consider solutions (H(x,epsilon),G(x,epsilon)) of the von Karman equations for the swirling flow between two rotating coaxial disks. This work considers the shapes and asymptotic behavior as epsilon approaches 0 plus. We consider the kind of limit functions that are permissible. The only possible limits (interior) for G(x,epsilon) are constants. If that limit constant is not zero, then 1/sq.rt. epsilon H(x,epsilon) will also tend to a constant. GRA

N79-29482# Idaho National Engineering Lab., Idaho Falls.

DRAG-DISC TURBINE TRANSDUCER DATA EVALUATION METHODS FOR DYNAMIC STEAM-WATER MASS FLOW MEASUREMENTS

C. E. Winsel, J. R. Fincke, and V. A. Deason 1979 10 p refs Presented at 25th ISA Intern. Instrumentation Symp., Anaheim, Calif., 7 May 1979

(Contract EY-76-C-07-1570)

(CONF-790505-3) Avail: NTIS HC A02/MF A01

The mechanical design of a two-phase mass flow rate transducer for a highly corrosive, high temperature (651 K) hot water environment is presented. Performance data for transient steam-water flows are presented. Details of the applications of the device during loss-of-coolant experiments in a pressurized water reactor environment are discussed. DOE

N79-29483# Los Alamos Scientific Lab., N. Mex.

MEASUREMENT AND ANALYSIS OF DRAG IN MULTIPHASE FLOW SYSTEMS

P. E. Rexroth and V. S. Starkovich 1979 16 p refs Presented at 2nd Multiphase Flow and Heat Transfer Symp. Workshop, Miami Beach, Fla., 16-18 Apr. 1979

(Contract W-7405-eng-36)

(LA-UR-79-811; Conf-790423-7) Avail: NTIS HC A02/MF A01

A combined experimental and analytical program undertaken

to evaluate an interfield momentum coupling model used in the computer code SIMMER is described. The behavior of a slugging, vapor particle flow system was observed and recorded using gamma densitometry, differential pressure measurement, and motion pictures. The primary parameter observed was slug period. When the system was modeled using SIMMER, the calculated behavior of the flow was qualitatively similar to that observed experimentally, but both the period and maximum slug height were underestimated, indicating too weak coupling between the vapor and particle fields. The SIMMER drag correlation was modified, resulting in much better agreement. Final discrepancies between experiment and analysis are discussed. DOE

N79-29484# Los Alamos Scientific Lab., N. Mex.
NUMERICAL SIMULATION OF THREE-DIMENSIONAL FLUID-STRUCTURE RESPONSE
W. C. Rivard and M. D. Torrey 1979 18 p refs
(Contract W-7405-eng-36)
(LA-UR-78-3271) Avail: NTIS HC A02/MF A01

Three-dimensional, coupled, fluid-structure calculations were performed for the dynamics of the core support barrel in an HDR reactor vessel during blowdown. For these calculations the three-dimensional, two-fluid code K-FIX was coupled to the three-dimensional elastic shell code FLX. The coupling procedure is described, and conditions derived from truncation error and Fourier analysis are given for numerical stability of the separate and coupled finite difference solution algorithms. The results demonstrate the importance of the coupled interactions on the structural response. A nodalization study indicates the degree of circumferential and axial resolution required for accurate results. Fine axial resolution is needed near the top built-in boundary of the core barrel to determine stresses accurately, but it is less necessary for displacements. DOE

N79-29485# Centre Technique des Industries Mecaniques, Senlis (France).
VISUALIZATION OF THE FLOW THROUGH A SCREW-DOWN VALVE WITH A FLAT VALUE SEAT (DN 80) [VISUALISATION DE L'ECOULEMENT DANS UN ROBINET A SOUPAPE TETE DROITE DN 80]
D. Peyrot 24 Jan. 1978 62 p In FRENCH
(CETIM-1-4G-07-0) Avail: NTIS HC A04/MF A01

A technique for studying flow patterns through values was developed in order to characterize these flow control apparatus and then, if possible, improve their configurations. Data is primarily gathered from photographs and/or motion pictures taken of the actual flow. A correlation is made between the valve size and the flow rate. Pressure fluctuations at the valve inlet and at the outlet are also commented on. The role of noise, resulting from flow past the various valve surfaces, in determining the efficiency of a valve configuration is discussed. Results obtained specific to the screw-down value type DN 80 are used to illustrate the method. Author (ESA)

N79-29486# Microtecnica, Turin (Italy).
FACILITIES FOR FLUID LOOP COMPONENTS Final Report
F. Filippi, A. Arcidiacono, and V. Marchis Paris ESA 15 Sep. 1978 80 p
(Contract ESTEC-2995/76-NL-PP(SC))
(M-RT-670) Avail: NTIS HC A05/MF A01

Some aspects of the development program for the experimental liquid cooling loop (ECL) designed to be used for the thermal conditioning of experiment payloads on board Spacelab and other manned spacecraft were studied. Cost and time schedule for the development program of the basic ECL (water and Freon core loop), methods and facilities for ECL qualification testing, key hardware specifications, ECL test procedures, feasibility of using the ECL modules, and existing components or supplies willing to develop them are discussed. Author (ESA)

N79-29487# Research Inst. of National Defence, Stockholm (Sweden).
MODELS FOR THE CALCULATION OF CHLORINE GAS LEAKAGE FROM PRESSURE TANKS [MALLAR FOER BERAEKNING AV UTSTROEMNING AV KLORGAS FRAAN TRYCKTANKAR]
Christina Holmberg Dec. 1978 11 p In SWAHILI
(FOA-C-40092-H2) Avail: NTIS HC A02/MF A01

Based on gas flow rate data previously determined, a computer was used to describe gas leakage from a tank containing condensed chlorine. Computer models were developed in order to facilitate the analysis of risks resulting from accidental chemical leakage. A normative diagram derived from these models is presented and is intended to be used in calculating chlorine gas leak rates from tanks of arbitrary shape and size as well as with different puncture sizes and at various temperatures. An explanation of how the diagram can be used to practically describe certain leak characteristics is also included. Author (ESA)

35 INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.

For aerial photography see *43 Earth Resources*. For related information see also *06 Aircraft Instrumentation*, and *19 Spacecraft Instrumentation*.

N79-29488 Rochester Univ., N. Y.
HIGH ORDER PSEUDOHOLOGRAPHY USING ZONE PLATES Ph.D. Thesis
Joshua Gur 1978 264 p
Avail: Univ. Microfilms Order No. 7914469

The potential and the power of the technique described for obtaining high resolution X-ray images of imploded pellets in laser pellet-compression experiments is demonstrated. Considerable insight, to the high order focusing capability of zone plates, is gained by first studying the analogies between zone plates and diffraction gratings. The formal mathematical framework of pseudoholography is rederived, including the reconstructions at high orders. The construction of X-ray zone plate camera for laser pellet compression measurements is described. Results from some pellet compression experiments are shown demonstrating an increase of resolution at high orders. A resolution test for the zone plate camera is performed. An optical simulation of an X-ray experiment is described showing the feasibility of using one dimensional zone plate coded aperture to spatially resolved spectra. Dissert. Abstr.

N79-29489 Michigan State Univ., East Lansing.
THE DESIGN AND APPLICATION OF A VIDICON RAPID SCANNING SPECTROPHOTOMETER TO STOPPED-FLOW KINETICS Ph.D. Thesis
Erik Mattis Carlson 1978 230 p
Avail: Univ. Microfilms Order No. 7917682

A rapid scanning stopped-flow spectrophotometer was developed. The use of a silicon vidicon array detector enables reactions to be simultaneously monitored over a spectral region of approximately 260 nm. The instrument is controlled by a multi-microcomputer system. One microcomputer controls the vidicon spectrophotometer. The complete automation of the stopped-flow mixing system is handled by a second microcomputer. Another microcomputer handles interactions with the operator, mass data storage and communications with a laboratory minicomputer. A fourth microcomputer coordinates the activities of the other three. A new computer language called CONVERS-M was developed to operate in the multi-microcomputer system. The instrument was applied to an investigation of unusual reaction rates encountered in a kinetic method for determining the total protein content of human blood serum using the biuret reaction. Dissert. Abstr.

N79-29490 Maryland Univ., College Park.
A HIGH-SPEED, BACKGROUND CORRECTED, SIMULTANEOUS MULTIELEMENT ATOMIC ABSORPTION SPECTROMETER Ph.D. Thesis
James Merlin Harnly 1978 279 p
Avail: Univ. Microfilms Order No. 7917135

Research was conducted for the development of a working, multielement spectrometer based on a new type of atomic absorption spectrometer, AAS. This instrument consists of an

Eimac, Xenon arc continuum source and an echelle monochromator which was modified for wavelength modulation. This AAS was named CEWM-AAS. The design and construction of an electronic circuit for the real-time computation of absorbance is presented. This allows CEWM-AAS to be used in the single element mode with the same facility as any commercially available instrument. The conversion of CEWM-AAS to a multielement spectrometer using graphite furnace atomization is described. Multielement CEWM-AAS with a graphite furnace offers the best simultaneous detection limits of any commercially available spectrometric system. Dissert. Abstr.

N79-29491 Washington State Univ., Pullman.
THE HOLOGRAPHIC CAMERA FOR THREE-DIMENSIONAL MICROGRAPHY OF THE ALERT HUMAN EYE Ph.D. Thesis
Allan Rikio Tokuda 1978 209 p
Avail: Univ. Microfilms Order No. 7917651

The holographic recording of the entire cornea-to-retina depth on an alert human subject is presented. A birefringence effect was discovered with a crossed-polarizer configuration. A fail-safe shutter system prevents dangerous laser irradiation of the eye with exposure durations of 0.3 msec. Pilot human trials indicate this is short enough to permit holography of an alert human eye. A single mode argon-ion laser emitting 2.5 W at 514.5 nm has a coherence length adequate for recording sharp optical interference throughout the depth of the eye. A theoretical model of holography of the alert eye is confirmed on an oscillating model fundus eye. Holography of rabbits' eyes shows the progress over time of microwave-induced cataracts. Photographs from the holographic system and the slit lamp biomicroscope and the fundus camera are compared. Dissert. Abstr.

N79-29492*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
CONTAINERLESS HIGH TEMPERATURE CALORIMETER APPARATUS Patent Application
Lewis L. Lacy, Michael B. Robinson, and Daniel B. Nisen, inventors (to NASA) Filed 29 Jun. 1979 15 p
(NASA-Case-MFS-23923-1; US-Patent-Appl-SN-053569) Avail: NTIS HC A02/MF A01 CSCL 14B

An instrument is disclosed for measuring high temperature thermophysical properties of materials which includes a unique containerless heating apparatus wherein the specimen is suspended and heated by electron bombardment. NASA

N79-29493*# LeMoyne-Owen Coll., Memphis, Tenn.
THE CALIBRATION OF THE QUARTZ CRYSTAL MICROBALANCE CASCADE IMPACTOR USING THE BERGLUND-LIU MONODISPERSE AEROSOL GENERATOR FOR AEROSOL STUDIES IN THE ATMOSPHERE
Nathaniel Matthews [1978] 7 p refs
(Grant NsG-1593)
(NASA-CR-158624) Avail: NTIS HC A02/MF A01 CSCL 14B

The Quartz Crystal Microbalance was calibrated and its response to particle size and mass concentration was determined. R.E.S.

N79-29494# Aeronautical Research Labs., Melbourne (Australia).
A CASSETTE TAPE RECORDER/READER INTERFACE FOR MICROPROCESSORS
P. Ferrarotto Nov. 1978 27 p refs
(AD-A068370; ARL/AERO-TM-311) Avail: NTIS HC A03/MF A01 CSCL 09/2

This unit was designed to enable digital data or computer programs to be recorded on domestic quality cassette tape recorders, and thus provide an inexpensive and convenient method for the exchange or long-term storage of data or programs. It was specifically designed for use with microprocessors as an alternative to paper tape. This unit has been built to conform with the requirements of the RS. 232 standard, and may be connected to terminals or computers which conform to this standard. GRA

N79-29495# Ford Aerospace and Communications Corp., Newport Beach, Calif. Aeronutronic Div.
MACHINE HOLOGRAPHY Final Report
Chester L. Richards 30 Mar. 1979 122 p refs
(Contract N00014-78-C-0659)
(AD-A068638; U-6516) Avail: NTIS HC A06/MF A01 CSCL 14/5

This is the final report of a theoretical and experimental investigation into some properties of holograms. Optical holograms suffer from the existence of complex conjugate terms and nonlinearities which add an unavoidable amount of clutter. Because we were able to perform our experiments using a digital computer (Data General Eclipse), these conjugate terms and nonlinearities were not present. This provided a certain cleanness in the mathematics which will be evident. It also showed that the essential properties of the hologram are not restricted to a wave propagation environment. Thus, we have chosen to provide the general name of Machine Holography for our investigation. The name implies that the principles investigated here may be embodied by diverse types of machinery, not just laser based optical systems. The investigation was divided into two packages. The first explored the ultimate storage capacity of what we have come to call Conventionally Multiplexed Holograms. These are holograms which are multiplexed by a summation process whereby each reference pattern participating is uncorrelated with the other references in the ensemble. The primary goal of the second package of work was to demonstrate that a hologram could be trained to reliably distinguish between two highly correlated (reference) patterns. In an effort to design a training paradigm to demonstrate this prediction, a new kind of machine was discovered. This new machine put a negative feedback loop around the hologram. The hologram then became part of a servo mechanism in which both the controller of the servo and the object of control was the stored hologram. GRA

N79-29496# Smithsonian Astrophysical Observatory, Cambridge, Mass.
DEVELOPMENT OF A HIGH RESOLUTION, HIGH SENSITIVITY CYLINDRICAL CRYSTAL SPECTROMETER FOR LINE SHAPE DIAGNOSTICS OF X-RAYS EMITTED FROM HOT PLASMAS Progress Report, 1 Aug. 1977 - 31 Jul. 1978
P. O. Taylor and H. Schopper May 1978 30 p refs
(Contract EY-76-S-02-4041)
(COO-4021-2) Avail: NTIS HC A03/MF A01

The spectrometer was designed to interface with the MIT Tokamak spectrometer with the initial aim of studying the prominent MoL lines which occur in the X-ray spectrum. It has the versatility to function over an energy range of at least 1.5 keV to 7 keV allowing determination of temperature, charge state and density distributions for important impurity ions. The spectrometer employs a large, cylindrically bent crystal which focuses the dispersed X-rays along the cylinder axis where they are recorded by a position sensitive proportional counter. Thus, a wide energy range of the spectrum can be recorded simultaneously and sensitively from a short duration plasma. Computer control of data acquisition and analysis allows real time diagnostics. DOE

N79-29497# Idaho National Engineering Lab., Idaho Falls.
IMAGING OPTICAL PROBE FOR PRESSURIZED 620 DEG K STEAM-WATER ENVIRONMENT
M. R. Donaldson, R. E. Pulfrey, and S. K. Merrill 1979 15 p Presented at 25th ISA Intern. Instrumentation Symp., Anaheim, Calif., 7 May 1979
(Contract EY-76-C-07-1570)
(CONF-790505-5) Avail: NTIS HC A02/MF A01

An air cooled imaging optical probe, 0.3 m long with a 25.4 mm outside diameter, was built to provide high resolution viewing of flow regimes in a steam water environment at 620 K and 15.5 MPa. The probe consists of a 3.5 mm diameter rod lens borescope, surrounded by two coaxial coolant flow channels and two coaxial insulating dead air spaces. With air flowing through the probe at 5.7 g/s, thermal analysis shows that no part of the optical borescope will exceed 366 K when the probe is immersed in a 620 K environment. The objective lens is protected by a sapphire window which tests have shown can survive over 200 hours in 620 K water or steam with negligible loss of resolution and contrast. Condensation on the protective window is boiled off by electrically heating the window. Computer stress analysis, plus actual tests, shows that the probe can operate successfully with conservative safety factors. DOE

N79-29498# Sandia Labs., Albuquerque, N. Mex.
PRESSURE MEASUREMENTS IN HARSH ENVIRONMENTS
C. W. Cook and E. S. Ames 1979 24 p refs Presented at 25th ISA Intern. Instrumentation Symp., Anaheim, Calif., 7 May 1979
(Contracts EY-76-C-04-0789; AT(29-1)-789)
(SAND-78-2289C; Conf-790505-4) Avail: NTIS HC A02/MF A01

A fluid coupled plate gage was designed which allows pressure measurements to be made in harsh environments (including debris) using conventional pressure transducers. The pressure transducer is isolated by means of a rigid force plate which is supported by a bellows having one corrugation. This portion of the gage is machined from a single piece of material. The interior of the gage is filled with a phenol fluid which has a low compressibility. DOE

N79-29499# Verfinstituut TNO, Delft (Netherlands).
THE TNO GRADIENT OVEN: BASIC INFORMATION
T. Doorgeest, J. F. A. Hazenberg, M. Hoeflaak, and H. J. Devries 7 Nov. 1978 20 p
(TNO-V-78-X) Avail: NTIS HC A02/MF A01

A gradient oven developed for paint research applications is presented. A description of the construction, operation, and use of the oven is given. Other possible applications of the oven are also suggested. Author (ESA)

36 LASERS AND MASERS

Includes parametric amplifiers.

N79-29500 Stanford Univ., Calif.
LASER INDUCED ENERGY TRANSFER Ph.D. Thesis
Roger Wirth Falcone 1979 101 p
Avail: Univ. Microfilms Order No. 7917227

Two related methods of rapidly transferring stored energy from one excited chemical species to another are described. The first of these, called a laser induced collision, involves a reaction in which the energy balance is met by photons from an intense laser beam. A collision cross section was induced in an experiment which demonstrated the predicted dependence of the cross section on wavelength and power density of the applied laser. A second type of laser induced energy transfer involves the inelastic scattering of laser radiation from energetically excited atoms, and subsequent absorption of the scattered light by a second species. Applications in laser controlled chemistry and spectroscopy, and proposals for new types of lasers using these two energy transfer methods are discussed. Dissert. Abstr.

N79-29501 Stanford Univ., Calif.
LASER-INDUCED INTERACTIONS Ph.D. Thesis
William Randall Green 1979 130 p
Avail: Univ. Microfilms Order No. 7917235

Experimental and theoretical considerations of the laser-induced collision are discussed. Laser-induced collisions utilizing both a dipole-dipole interaction and a dipole-quadrupole interaction were experimentally demonstrated. The theoretical aspects of other related processes such as laser-induced spin-exchange, collision induced Raman emission, and laser-induced charge transfer are discussed. Experimental systems that could be used to demonstrate these various processes are presented. An experiment which produced an inversion of the resonance line of an ion by optical pumping of the neutral atom is described. This type of scheme was proposed as a possible method for constructing ultraviolet and X-ray lasers. Dissert. Abstr.

N79-29502 Washington Univ., Seattle.
WAVE DECAY DOWNSTREAM OF A NOZZLE ARRAY Ph.D. Thesis
T. S. Vaidyanathan 1979 104 p
Avail: Univ. Microfilms Order No. 7917655

Expansion generated waves are an important source of nonhomogeneity in the lasing medium of grid nozzle lasers. Flows containing decaying waves from two and dimensional nozzle grids were modelled and analyzed by employing a perturbation idea to yield the first solution for the near-field decay in two dimensions and for the entire field in three dimensions. The results are compared with method of characteristics calculations and with earlier measurements of the density disturbance integrated across the cavity. The complete solution brings out the dependence of flow quality on dimension, Mach number, expansion angle and ratio of specific heats. Application to real cavity flow is discussed. Dissert. Abstr.

N79-29503 City Univ. of New York, N. Y.
DYE LASER SYSTEM FOR MONITORING ATMOSPHERIC OZONE, SULFUR DIOXIDE AND NITROGEN DIOXIDE Ph.D. Thesis
Frank Ralph Barone 1979 267 p
Avail: Univ. Microfilms Order No. 7916979

A frequency doubled dye laser radar (LIDAR) system was designed, built and operated to measure ambient SO2 and O3 concentrations in the atmosphere. The LIDAR system operated using the differential absorption of scattered energy technique (DASE). This technique greatly increased sensitivity and range for detection of atmospheric SO2 and O3 as compared with other range resolved lidar schemes. The DASE system was subsequently analyzed to determine the sources of system concentration measurement error. Systematic error and random or statistical error were the two error sources considered. Dissert. Abstr.

N79-29504 Washington Univ., Seattle.
A LASER PHOTOCOAGULATING DIELECTRIC WAVEGUIDE SCALPEL Ph.D. Thesis
James Louis Doty 1978 146 p
Avail: Univ. Microfilms Order No. 7917555

The optical characteristics of the blade are analyzed and experimentally verified. Details are given concerning blade construction and the choices for optimum blade geometry. Coupling methods are related along with techniques for maximizing the overall optical efficiency of the system. Animal trials, devised to test the capabilities of the scalpel under clinical conditions, are detailed; the results are given, including documentation of an approximately three-fold reduction in blood loss when compared to electrocautery. Applications other than the debridement of third degree burns are discussed, along with modifications which can further increase the clinical scope of the laser blade. Experimental and historical comparisons of this scalpel and other bloodless scalpels illustrate the advantages obtained when using the laser blade. Dissert. Abstr.

N79-29505# Hughes Research Labs., Malibu, Calif.
OPTICAL-MICROWAVE INTERACTIONS IN SEMICONDUCTOR DEVICES Quarterly Report, 1 Jan. - 31 Mar. 1979
L. Figueroa, C. Slayman, and H. W. Yen Apr. 1979 38 p refs
(Contract N00173-78-C-0192)
(AD-A068387; QR-3) Avail: NTIS HC A03/MF A01 CSCL 20/5

The results of an extensive experimental study of mode locking in semiconductor lasers with different external-cavity configurations are described. The generation of GaAs laser pulses less than 200 psec wide at approximately-GHz repetition rates was achieved by operating the laser in a 5-cm-long external cavity. The presence of a strong resonance at low frequencies in the laser actually aided the generation of short pulses. A novel external-cavity configuration using a piece of optical fiber is also described. Modulation frequencies as high as 4.26 GHz were obtained for lasers biased only slightly above threshold, and optical pulses as narrow as 200 psec were generated using this technique. A theoretical study of the response of GaAs FETs under optical illumination was presented. For a strong photo-transistor effect to occur in an FET requires that the region of active channel under the gate electrode be illuminated. A modified FET design suitable for this purpose is proposed and analyzed.Author (GRA)

N79-29506# Naval Research Lab., Washington, D. C.
ABLATIVE ACCELERATION OF LASER-IRRADIATED THIN FOIL TARGETS
R. Decoste, S. E. Bodner, B. H. Ripin, E. A. McLean, and S. P. Obenschain 9 Mar. 1979 11 p refs
(AD-A069083; AD-E000297; NRL-MR-3948) Avail: NTIS

HC A02/MF A01 CSCL 20/5

Ablative acceleration of thin foil targets at low laser irradiance (10 to the 12th power -10 to the 13th power W/sq cm) are studied experimentally and theoretically. Ablative acceleration of foils up to approximately 10 to the 7th power cm/sec with good hydrodynamic efficiency (20%) have been achieved. These and other results are in good agreement with a simple rocket model. GRA

N79-29507# National Bureau of Standards, Washington, D. C.
LASER INDUCED DAMAGE IN OPTICAL MATERIALS, 1978
Alexander J. Glass, ed. and Arthur H. Guenther, ed. Dec. 1978 366 p refs Proc. of the 10th Ann. Symp. on Opt. Mater. for High Power Lasers, Boulder, Colo., 12-14 Sep. 1978; sponsored by NBS, Am. Soc. for Testing and Mater., ONR, DOE and ARPA
(AD-A068924; NBS-SP-541; LC-79-600050) Avail: NTIS MF A01; SOD HC $5.50 CSCL 20/5

The Tenth Annual Symposium on Optical Materials for High Power Lasers was divided into sessions concerning the measurement of absorption characteristics, bulk material properties, mirrors and surfaces, thin film damage, coating materials and design and breakdown phenomena. As in previous years, the emphasis of the papers presented at the symposium was directed toward new frontiers and new developments. Particular emphasis was given to materials for use from 10.6 micrometers to the UV region. Highlights included surface characterization, thin film-substrate boundaries, and advances in fundamental laser-matter threshold interactions and mechanisms. The scaling of damage thresholds with pulse duration, focal area, and wavelength were also discussed. GRA

N79-29508# Science Applications, Inc., Ann Arbor, Mich.
SPECTROSCOPIC DATA BASE FOR LASER TRANSMISSION MODELING Final Report
D. R. Woods, D. H. Leslie, J. L. Manning, and R. E. Meredith Dec. 1977 164 p refs
(Contract N00173-76-C-0152)
(AD-A069020; SAI-77-012-AA) Avail: NTIS HC A08/MF A01 CSCL 20/6

High resolution (approx. - .05/cm) molecular line absorption measurements have been performed in the 3-5 micrometer spectral region. This data completes the measurements activities directed toward developing field verified predictive modeling of DF laser atmospheric molecular absorption. Some 181 HDO line profile measurement sets are presented for the path length and partial pressure combinations required to determine the air broadened HDO line parameters. Also, synthetic atmospheric molecular absorption spectra have been generated for the several molecular absorbers (N2O, CH4, HDO, CO2) known to be important in the DF laser region. During the course of the DF transmission modeling effort, it became apparent that the line of sight molecular content should depend on the location and environmental conditions. To monitor the HDO molecular content, a Gas Filter Correlation Spectrometer (GFSC) was designed, constructed and delivered to NRL. Since the variability of HDO in the real atmosphere was shown by NRL to be quite dramatic and important, a design study to expand the GFCS capability was initiated. This study is included in this report. GRA

N79-29509# Airtron, Inc., Morris Plains, N.J. Airtron Div.
PREPARATION OF RARE EARTH DOPED LASER MATERIALS Annual Summary Report, 1 Oct. 1977 - 1 Oct. 1978
R. F. Belt and L. Drafall Jan. 1979 34 p refs
(Contract N00014-76-C-0070)
(AD-A069008) Avail: NTIS HC A03/MF A01 CSCL 20/5

This report describes the preparation of both polycrystalline and single crystal host materials which may prove to be suitable for new lasers. Three classes of hosts were examined along with specified lanthanide dopants. The latter were most frequently the elements Ce, Pr, Er, and Yb. Single crystals of YAG were grown by the Czochralski method in production pullers. Dopants were added under controlled atmospheric conditions. Various fabricated optics such as polished rods, disks, or rectangular parallel pipeds were constructed for active laser testing. A significant study was made on high melting oxidic hosts with a fluorite crystal structure. GRA

N79-29510# Army Environmental Hygiene Agency, Aberdeen Proving Ground, Md.
HAZARD EVALUATION OF THE COHERENT MODEL 900 PHOTOCOAGULATOR LASER SYSTEM Special Study, Jan. - Feb. 1979
David L. Jenkins Feb. 1979 16 p refs
(AD-A068713; USAEHA-25-42-0310-79) Avail: NTIS HC A02/MF A01 CSCL 06/18

A special study of the Coherent Model 900 photocoagulator was performed by this Agency. It was determined that the laser emits optical radiation exceeding current protection standards. It was also determined that although the alignment beam, when reflected back through the slit-lamp optics, exceeds prolonged viewing standards at the higher alignment beam powers, the alignment beam will not present a significant hazard at normal settings for surgical procedures. GRA

N79-29511# Army Missile Research and Development Command, Redstone Arsenal, Ala. High Energy Laser Lab.
COMPILATION OF DATA RELEVANT TO NUCLEAR PUMPED LASERS, VOLUME 3
E. W. McDaniel (Georgia Inst. of Technol.), M. R. Flannery (Georgia Inst. of Technol.), E. W. Thomas (Georgia Inst. of Technol.), H. W. Ellis (Georgia Inst. of Technol.), K. J. McCann (Georgia Inst. of Technol.), S. T. Manson (Georgia State Univ.), J. W. Gallagher (Joint Inst. for Lab. Astrophys.), J. R. Rumble (Joint Inst. for Lab. Astrophys.), E. C. Beaty (Joint Inst. for Lab. Astrophys.), and T. G. Roberts Dec. 1978 463 p refs
(AD-A068679; DRDMI-H-78-1-Vol-3) Avail: NTIS HC A02/MF A01 CSCL 20/5

This volume, and the succeeding Volumes Number IV and V, contain a compilation of data relevant to nuclear pumped lasers and are part of a series on atomic and molecular data for gas laser research and development. Volumes III, IV, and V contain data on many different species of atoms, molecules, and ions: a large fraction of them are already of direct interest in laser media; many more may become important in the future. These volumes cover all of the subjects treated in Volumes I and II; one difference is that now secondary electron energy spectra are discussed in a separate chapter. A chapter on nuclear data has also been added. GRA

N79-29512# Joint Inst. for Lab. Astrophysics, Boulder, Colo.
PHOTODETACHMENT STUDIES OF MOLECULAR NEGATIVE IONS Final Report, 15 Apr. 1976 - 31 Dec. 1978
W. C. Lineberger 1 Apr. 1979 46 p refs
(Grants DAAG29-76-G-0236; DAAG29-78-G-0096; NSF PHY-76-04761; NSF CHE-75-01565)
(AD-A069563; ARO-14118.1-P; ARO-16023.1-P) Avail: NTIS HC A03/MF A01 CSCL 07/4

Photoelectron spectrometry and threshold photodetachment spectroscopy have been used to obtain the electron affinity of O3 (2.1028 eV). A photodissociation model is proposed. GRA

N79-29513# Addis Translations International, Portola Valley, Calif.
LASER AND ENERGETICS OF THE FUTURE
N. Basov and L. Feoktistov Mar. 1979 8 p Translated into ENGLISH from Pravda, USSR, no. 35, 8 Mar. 1978
(UCRL-Trans-11467) Avail: NTIS HC A02/MF A01

It is shown that atomic energy should and can be viewed by mankind not as a military threat but as a source of abundant energy. The achievements of science provide sufficient grounds for this. Of course, controlling the fusion reaction is not the only possible solution to the energy problem. Moreover, it is widely believed that the most important role in this sphere belongs to energy produced by uranium fission. This suggests that other possible sources, such as solar, geothermal energy, will either not be developed in time or will not provide an adequate solution. DOE

N79-29514# Sandia Labs., Livermore, Calif.
ANALYSIS OF PARTICLE-TEMPERATURE MODULATIONS INDUCED BY PULSED-LASER SOURCES
W. L. Flower and J. A. Miller Mar. 1979 29 p refs Presented at Spring Meeting on Western States Sect., and the Combust. Inst., Provo, Utah, 23-24 Apr. 1979
(Contract EY-76-C-04-0789)

(SAND-79-8607; Conf-790434-1) Avail: NTIS HC A03/MF A01

A simple model was developed to study the thermal behavior of particles in combustion gases when irradiated by pulsed laser sources used for Raman-scattering measurements. DOE

N79-29515# Pennsylvania State Univ., University Park.
DOUBLED Nd-GLASS LASER SYSTEM FOR INCOHERENT THOMSON SCATTERING FROM LOW DENSITY PLASMAS
B. A. Jacoby, T. M. York, and R. A. Mollo Feb. 1979 12 p refs
(Contract EY-76-S-02-4020)
(COO-4020-8) Avail: NTIS HC A02/MF A01

Conventional Thomson scattering using a ruby laser evidences difficulty in scattered signal detection as electron densities drop below 10 to the 13th power/cu cm. Plasmas, such as theta pinch endloss flow, require resolution in that range. Use of a Nd-Glass Laser as a source and frquency doubling the output results in increases in the incident energy and quantum efficiency of the detectors such that gains in scattered signal, greater than an order of magnitude over a conventional ruby laser system, are achieved. Due to the 25 A bandwdith of the Nd-Glass Laser line, the electron temperature information in the incoherent scattered signal must be extracted from a Voight profile. DOE

37 MECHANICAL ENGINEERING

Includes auxiliary systems (non-power); machine elements and processes; and mechanical equipment.

N79-29516 British Library Lending Div., Boston Spa (England).
VDI GUIDELINE 2230. SYSTEMATIC CALCULATION OF HIGH DUTY BOLTED JOINTS
Feb. 1979 125 p refs Transl. into ENGLISH of report from Verein Deut. Ing., Dusseldorf
(BLL-CTO-1564-(9091.9F)) Copyright. Avail: British Library Lending Div., Boston Spa, Engl.

Research on the design of bolted joints is presented. After an analysis of the relationships presented in the literature for concentrically stressed and concentrically loaded bolted joints, formulas are derived for the eccentrically stressed and/or eccentrically loaded joints frequently found in practice. Tables, diagrams and examples are presented. Measurements of the influences arising from the scatter of the working loads during the tightening of bolted joints are reported. M.M.M.

N79-29517 Drexel Univ., Philadelphia, Pa.
AN ULTRASONIC DESIGN TOOL AND EXPERIMENTAL TEST BED FOR THE PREDICTION OF ADHESIVE BOND STRENGTH Ph.D. Thesis
Graham Havens Thomas 1979 161 p
Avail: Univ. Microfilms Order No. 7917194

An ultrasonic system including the tools and resource base for the development of an adhesive bond inspection algorithm is described. This experimental test bed incorporates the ultrasonic and computer equipment necessary to acquire and process data from various types of adhesively bonded test specimens. The computer hardware and software were developed to allow the design of reliable pattern recognition algorithms for the prediction of adhesive bond strength. This design tool may be used for a variety of adhesive bond systems and their respective defects. A sample problem of predicting the adhesive bond strength for an aluminum to aluminum step-lap joint whose strength could be affected by adhesive or cohesive defects is considered. Implementation concepts for the development of a practical test instrument in the field are also studied. Dissert. Abstr.

N79-29518 Drexel Univ., Philadelphia, Pa.
A DESIGN TOOL AND TEST BED CONCEPT FOR ULTRASONIC INSPECTION OF AUSTENITIC STAINLESS STEEL PIPE WELDS Ph.D. Thesis
Gurvinder Pal Singh 1979 191 p
Avail: Univ. Microfilms Order No. 7917196

A test bed concept and various design tools based on the factors which most influence the success of any ultrasonic test results such as beam pattern of the transducer, attenuation characteristics and reflector classification methodology were developed. A transducer design evaluation and optimization tool, in terms of ultrasonic field analysis computer program was developed. Sample results for various parametric studies are included to illustrate the utility and applicability of this design tool. A dual element transmitter-receiver angle beam probe is selected based on attenuation considerations. Signal to noise ratio studies and gain studies are carried out and results reported for the transducer selection for pattern recognition classification algorithm development. Dissert. Abstr.

N79-29519 Virginia Univ., Charlottesville.
STABILITY AND NONLINEAR RESPONSE OF ROTOR-BEARING SYSTEMS WITH SQUEEZE FILM BEARINGS Ph.D. Thesis
Lloyd Edward Barrett 1978 331 p
Avail: Univ. Microfilms Order No. 7916233

A method of analyzing the first mode stability and unbalance response of multimass flexible rotors is presented whereby the multimass system is modeled as an equivalent single mass modal model including effects of rotor flexibility, general linearized hydrodynamic journal bearings, squeeze film bearing supports and rotor aerodynamic cross coupling. Expressions for optimum bearing and support damping are presented for both stability and unbalance response. The method is intended to be used as a preliminary design tool to quickly ascertain the effects of bearing and support changes on rotor-bearing system performance. Methods of calculating the nonlinear squeeze film bearing forces for finite length bearings are developed which are computationally faster than finite difference and finite element methods generally used. Dissert. Abstr.

N79-29520# Boeing Commercial Airplane Co., Seattle, Wash.
NEW CONCEPTS IN AIRCRAFT JOURNAL BEARINGS Final Report, May 1976 - Aug. 1978
W. F. Lynn Aug. 1978 96 p refs
(Contract F33615-76-C-3098; AF Proj. 2402)
(AD-A068619; AFFDL-TR-78-97) Avail: NTIS HC A05/MF A01 CSCL 13/9

An exploratory development and test program was conducted to establish optimum materials and designs for composite material journal bearings in aircraft joints between structural components of both advanced composite and conventional metallic materials. An initial study and design phase evaluated the characteristics of candidate composite materials as they apply to highly loaded bearings in adverse environments. A second phase involved fabrication and testing of journal bearing configurations. In the study and design phase, composites of epoxy resin reinforced with fibers of graphite, glass, TFE, and Kevlar were evaluated in corrosion, strength, and wear/life tests. Cost, relative weight, and suitability for commercial manufacture were considered. Also, suitability for direct substitution of composite journal bearings for currently used metallic journal bearings was a major program goal. Early testing indicated that graphite filament-reinforced composites lacked suitable friction and wear characteristics and were subject to edge breakdown due to pin bending and accepted degrees of joint misalignment. The best combination of characteristics was obtained in filament wound glass or Kevlar fibers impregnated with epoxy resins. Suitable wear/life and friction characteristics were obtained by incorporating TFE fabric or sprayed TFE-enriched resin liners in the composite journal bearings. GRA

N79-29521# Harry Diamond Labs., Adelphi, Md.
AN INITIAL MODEL FOR THE FINITE DISPLACEMENT RESPONSE CHARACTERISTICS OF A FLUIDYNE PUMP
Tadeusz M. Drzewiecki Feb. 1979 43 p refs
(DA Proj. 1T1-61101-A-91A)
(AD-A069159; HDL-TR-1868) Avail: NTIS HC A03/MF A01 CSCL 20/13

This paper is the final report on the independent laboratory in house research (ILIR) sponsored work by the Harry Diamond Laboratories on the Fluidyne pump. The effort started with a survey of the extant literature on the subject, continued with experimental observations that led to a mathematical model, and has culminated with a comprehensive statement on the physical operation of the pump. The literature is particularly sparse on the subject; hence, only the basic references are cited. The

report presents a detailed mathematical model of the fluid mechanical and thermodynamic processes occurring during oscillation. A positive-feedback simulation model is postulated that demonstrates, for the first time, physically why there is an onset of oscillations and subsequent sustained motion. This model is based on actual observations of the startup process in a prototype pump. The initially reported thermodynamic efficiency of this heat engine was less than 0.3 percent. Currently, Fluidyne pumps have demonstrated efficiencies of about 2 percent. The peak efficiencies, however, may theoretically approach 10 percent. The mathematical model has shown that large losses occur in the heat transfer to the working gas, heat losses to the displacer liquid, and friction in the output line. Improvements in these areas may dramatically improve the observed overall efficiency. The efficiency of the cycle itself, that is, the work done by the thermodynamic cycle relative to the output work, is on the order of 10 percent. GRA

N79-29522# Detroit Diesel Allison, Indianapolis, Ind.
GAS TURBINE ENGINES AND TRANSMISSIONS FOR BUS DEMONSTRATION PROGRAMS Technical Status Report, 28 Aug. - 30 Oct. 1978
G. J. Gomolak Oct. 1978 7 p
(Contract EM-78-C-02-4867)
(COO-4867-1) Avail: NTIS HC A02/MF A01

Progress in the procurement of gas turbine engines and automatic transmissions and the required associated software for the bus demonstration programs is reported. All hardware items were defined and were released for procurement. Engine and transmission hardware is being received, and is approximately 25 percent completed at this time. The September 1978 Cost Report and engine and transmission installation drawings were delivered to the DOE on schedule. The program is progressing as planned and all items are on schedule for delivering the first engine/transmission at the end of April 1979. DOE

N79-29523# Lincoln Lab., Mass. Inst. of Tech., Lexington.
MOTOR STARTING WITH PV SYSTEMS
E. E. Landsman Jun. 1978 6 p Presented at IEEE Photovoltaic Specialists Conf., Wash., D. C., 5-8 Jun. 1978
(Contract EY-76-C-02-4094)
(COO-4094-16; Conf-780619-19) Avail: NTIS HC A02/MF A01

If photovoltaic power systems (PVPS) are to have significant impact, they must be able to accommodate ac motor loads. An attractive solution to the problems is to utilize a variable voltage/frequency motor starting scheme. The motor is started at low frequency, and a correspondingly scaled voltage. The voltage and frequency are both slowly increased to the nominal running values. This procedure allows starting the motor with stall torques comparable to those obtained from across-the-line starting but with virtually no input power transient. DOE

N79-29524# Barber-Nichols Engineering Co., Arvada, Colo.
TECHNOLOGY ASSESSMENT OF GEOTHERMAL PUMPING EQUIPMENT Final Report, Jul. 1978
Kenneth E. Nichols and A. J. Malgieri Sep. 1978 88 p refs
(Contract EG-77-C-04-4162)
(ALO-4162-2) Avail: NTIS HC A05/MF A01

Interviews were conducted with DOE personnel, DOE contractors doing geothermal research, persons associated with geothermal installations, companies engaged in the drilling and completion of geothermal well, and pump manufactures. The reports of these interviews are presented and summarized and conclusions are drawn. DOE

N79-29525# Aerospace Corp., El Segundo, Calif.
DIESEL ENGINE RESEARCH AND DEVELOPMENT STATUS AND NEEDS
W. U. Roessler, R. R. Covey, G. J. Mascetti, and R. B. Boulay Sep. 1978 194 p refs
(Contract EM-78-C-03-2184)
(SAN-2184-1) Avail: NTIS HC A09/MF A01

The research and development status of the automotive diesel engine/vehicle sector is sumarized, and specific basic and applied research and development needs in the diesel technology and health effects areas where active participation by the government would be desirable are identified. DOE

N79-29526# Centre Technique des Industries Mecaniques, St. Denis (France).
GEAR TEETH SUPERFICIAL WEAR CHARACTERIZATION THROUGH THE REPRESENTATION OF SURFACE RELIEF Final Report [CARACTERISATION DE L'USURE SUPERFICIELLE DES DENTS D'ENGRENAGE PAR UNE REPRESENTATION DE L'ETAT DE SURFACE DONNANT L'ASPECT DU RELIEF]
J. Chalier and J. C. Raffy 24 Mar. 1978 67 p refs In FRENCH
(CETIM-1-4H-19-0) Avail: NTIS HC A04/MF A01

Pignon gears made of different types of steel were subjected to various working conditions. Tests conducted included a 120 hr meshing test and a 250 hr three-dimensional ruggedness test. Gears were tested both in the 'breaking in' condition and in the 'in service' condition. Results are decomposed by time and work load. Empirical results are given graphically and are illustrated by photographs of meshing surface wear. Theoretical discussions and conclusions accompany each set of results. Author (ESA)

N79-29527# Centre Technique des Industries Mecaniques, St. Denis (France).
CONDITIONS FOR THE MACHINING OF VARIOUS TYPES OF METAL CARBIDES BY ELECTROEROSION Final Report [CONDITIONS D'USINAGE PAR ELECTRO-EROSION DE DIFFERENTES NUANCES DE CARBURE METALLIQUE]
R. Malosse May 1978 50 p In FRENCH
(CETIM-1-3G-04-0) Avail: NTIS HC A03/MF A01

Spark machining parameters, such as the chemical composition of the carbide to be machined, the type of electrode used, and the polarity of the electrode, were evaluated in order to determine their influence on technological characteristics, such as the rate at which material can be removed and its consequences for the rate of production, electrode wear, and the quality of surface which can be obtained on a machined piece. Several types of carbide having various chemical compositions were used as test specimens along with three different types of electrodes. Test results are given in detail and micrographs of machined surfaces are provided in an appendix. Author (ESA)

N79-29528# Oxford Univ. (England). Dept. of Engineering Science.
DETERMINATION OF JOINT CHARACTERISTICS FOR A KWIKSTAGE WEDGED JOINT OF THE 'c' PRESSING/'v' PRESSING TYPE
R. N. Faulkner 1978 21 p refs Sponsored by Transport and Road Res. Lab. of Dept. of Environ., UK
(OUEL-1249/78) Avail: NTIS HC A02/MF A01

A rigorous approach to the problems associated with load bearing scaffolds was taken by considering a scaffold coupler to be a short rigid offset having elastic connections at both ends. A theory similar to the single spring concept was applied to proprietary or system scaffolds employing wedged scaffold joints in preference to bolted couplers. Results are presented showing the various measured parameters and a comparison is drawn between the system joint and the tube and fittings coupler.
Author (ESA)

38 QUALITY ASSURANCE AND RELIABILITY

Includes product sampling procedures and techniques; and quality control.

N79-29529 Virginia Polytechnic Inst. and State Univ., Blacksburg.
THERMAL STRESS ANALYSIS AND LIFE PREDICTION OF A TIME-TEMPERATURE-DEPENDENT VISCOELASTIC HOLLOW CYLINDER SUBJECTED TO A TIME-DEPENDENT RANDOM TEMPERATURE Ph.D. Thesis
Asuquo J. OKono 1978 202 p
Avail: Univ. Microfilms Order No. 7917400

The solid propellant rocket motor, modelled as a time-temperature-dependent viscoelastic hollow cylinder subjected to a random thermal environment, was investigated. The thermal stress resulting from random environmental thermal effects during

storage was determined and the service life of the solid propellant rocket motor was calculated. The random temperature distribution within the modelled solid propellant rocket motor due to actual random temperature was studied. A finite element method was used in determining the temperature distribution within the cylinder at various times during the temperature variations. These values were used in obtaining the thermal stresses and strains within the solid propellant. The safety analysis was assessed from a probabilistic view point. The service life of the material was subsequently computed. Dissert. Abstr.

N79-29530*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

A REVIEW OF ISSUES AND STRATEGIES IN NONDESTRUCTIVE EVALUATION OF FIBER REINFORCED STRUCTURAL COMPOSITES

Alex Vary 1979 14 p refs Proposed for presentation at 11th Natl. SAMPE Tech. Conf., Boston, 13-15 Nov. 1979 (NASA-TM-79246; E-153) Avail: NTIS HC A02/MF A01 CSCL 14D

Techniques for quantitative assessment of the mechanical strength and integrity of fiber composites during manufacture and service and following repair operations are presented. Problems and approaches are discussed relative to acceptance criteria, calibrating standards, and methods for nondestructive evaluation of composites in strength-critical applications. Acousto-ultrasonic techniques provide the methods of choice in this area. M.M.M.

N79-29531# Lockheed-Georgia Co., Marietta.

PROCEEDINGS FROM THE GOVERNMENT/INDUSTRY WORKSHOP ON THE RELIABILITY OF NONDESTRUCTIVE INSPECTIONS

W. H. Lewis, W. H. Sproat, and W. M. Pless Dec. 1978 302 p Workshop held at Houston, Tex., 2-4 Aug. 1978 (Contracts F41608-76-D-A005; F41608-77-D-A021) (AD-A068223; LG78ER0261; SA-ALC/MME-76-6-38-2) Avail: NTIS HC A14/MF A01 CSCL 01/3

The NDI Reliability Workshop was held in Houston, Texas, on August 2-4, 1978, to present the results of the Air Force Logistics Command program, 'Determination of NDI Reliability,' and to provide a forum for evaluating the results and discussing approaches for NDI Reliability improvement. Attendance at the Workshop was limited to government and industry personnel whose primary interest was in nondestructive inspection, fracture mechanics, NDE equipment and quality assurance. The workshop consisted of formal presentations, working task groups involving all attendees, and a general discussion forum. These workshop proceedings contain a transcript of the general discussion forum which presented the task group conclusions and recommendations for nondestructive inspection improvement. GRA

N79-29532# Vought Corp. Advanced Technology Center, Inc., Dallas, Tex.

N-RAY INSPECTION OF AIRCRAFT STRUCTURES USING MOBILE SOURCES: A COMPENDUM OF RADIOGRAPHIC RESULTS Final Report, 18 May 1977 - 22 Dec. 1978

W. D. Dance 16 Apr. 1979 61 p refs (Contract N68335-77-C-0555; WF41461406) (AD-A068316; ATC-B-92200/8CR-137; NAEC-92-116) Avail: NTIS HC A04/MF A01 CSCL 01/3

This report presents a compendium of typical results of neutron radiographic inspections performed on aircraft structures and laboratory structural specimens. The radiographs are representative of the capability of isotope or small accelerator (nonreactor) neutron sources for imaging defects in aircraft and missile structures. The results show that: (1) the resolution and sensitivity of transportable sources are adequate for effective inspection of structures for many commonly occurring defects (the validity of the technique is established), and (2) the systems utilized to obtain these results prove the feasibility of making N-Ray systems sufficiently portable for field inspection of aircraft. Recommendations are made for implementing the transition from exploratory work to a routine field inspection capability. GRA

N79-29533# Martin Marietta Aerospace, Orlando, Fla.

RELIABILITY PREDICTION MODELS FOR MICROWAVE SOLID STATE DEVICES Final Technical Report, Sep. 1977 - Sep. 1978

George F. Guth Griffiss AFB, N. Y. RADC Apr. 1979 107 p refs (Contract F30602-77-C-0204; AF Proj. 2338) (AD-A069386; OR-15284; RADC-TR-79-50) Avail: NTIS HC A06/MF A01 CSCL 09/5

Martin Marietta Corporation conducted a 12 month program to develop base failure rates and failure rate mathematical models for microwave solid state devices. These models are provided in the format of MIL-HDBK-217B. More than 8.75 billion part hours of operating field data were collected from industrial and Government data sources. Data were analyzed and sorted manually. Conclusions are summarized in the revised base failure rates and mathematical models described. Failure rates developed for those devices already included in MIL-HDBK-217B are compared with present failure rates. Devices not presently included in MIL-HDBK-217B are listed with new pages for inclusion in MIL-HDBK-217B. GRA

N79-29534# Oak Ridge National Lab., Tenn. Metals and Ceramics Div.

STATISTICAL PRECISION OF DELAYED-NEUTRON NONDESTRUCTIVE ASSAY TECHNIQUES

C. K. Bayne and S. R. McNeany Feb. 1979 33 p refs (Contract W-7405-eng-26) (ORNL/TM-6569) Avail: NTIS HC A03/MF A01

A theoretical analysis of the statistical precision of delayed-neutron nondestructive assay instruments is presented. Such instruments measure the fissile content of nuclear fuel samples by neutron irradiation and delayed-neutron detection. The precision of these techniques are limited by the statistical nature of the nuclear decay process, but the precision can be optimized by proper selection of system operating parameters. The method is a three-part analysis: (1) differential-different equations describing the fundamental physics of the measurements are presented; (2) complete analytical solutions to the equations are derived and presented; and (3) equations governing the expected number and variance of delayed-neutron counts were computer programmed to calculate the relative statistical precision of specific system operating parameters. DOE

N79-29535# Ecole Nationale Superieure des Telecommunications, Paris (France). Dept. Electronique et Physique.

ESTABLISHING AUTOMATIC TEST SYSTEM SPECIFICATIONS SO AS TO BE COMPATIBLE WITH AN OPTIMAL MAINTENANCE POLICY AND EQUIPMENT RELIABILITY

Louis-Francois Pau 1979 7 p refs Presented at Ann. Reliability and Maintainability Symp., Washington, D. C. 23-25 Jan. 1979 (ENST-C-79002) Avail: NTIS HC A02/MF A01

The characteristics of an automatic test system (test frequency distribution; reliability; false alarm rate) were examined in order to integrate the test system with a maintenance policy. A decision rule was introduced to select between unscheduled repair or overhaul in order to minimize the maintenance costs per unit operational time. This decision rule is derived from a Markov model. Results were applied to the case of airborne equipment, and to a telecommunication system. Author (ESA)

N79-29536# Ecole Nationale Superieure des Telecommunications, Paris (France). Dept. Electronique et Physique.

DESIGN OF A SUB-OPTIMAL KALMAN FILTER OF VERY HIGH RELIABILITY AND SPEED, WITH INTERNAL RECONFIGURATION AND FAILURE LOCALIZATION

Louis-Francois Pau 1979 11 p refs Presented at 9th IEEE Decision and Control Conf., San Diego, Calif. 9-12 Jan. 1979 (ENST-C-79005) Avail: NTIS HC A02/MF A01

The implementation of a sub-optimal analog or hybrid Kalman filter is described streqsing reliability, robustness, and speed requirements. The filter is designed assuming mismatched dynamics, noise, drift, and computational errors. The state estimation error propagation is studied and time dependent bounds established in order to determine the reinitialization rate. Three alternate filter architectures are studied and their reliability computed. The device includes triple modular filter redundancy, failure detection, and localization logic. Author (ESA)

39 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; and thermal stress.

For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance*.

N79-29537 Arizona Univ., Tucson.
FINITE ELEMENT ANALYSIS OF FATIGUE CRACK GROWTH UNDER RANDOM LOADING Ph.D. Thesis
Hassan Sayyed Hussain Alawi 1979 207 p
Avail: Univ. Microfilms Order No. 7917340

The fatigue crack growth behavior is studied. The plastic deformation at the crack tip is considered using an elastoplastic approach. The changing boundary conditions due to the crack surface closure, opening, and growth are also taken into account. The decomposed global stiffness matrix is updated using an efficient technique instead of reformulating it after each boundary change. Narrow-band random loads with peaks having the Rayleigh probability density function are generated on a computer. The findings on crack tip behavior under cyclic loading are reported. Based on the findings a model for estimating the fatigue life of a structure with a crack under random loading is suggested. Dissert. Abstr.

N79-29538 Michigan Univ., Ann Arbor.
HARMONIC WAVE PROPAGATION IN POROUS MEDIA AND IN FIBER REINFORCED VISCOELASTIC MEDIA
Tien-Chi Ma 1979 100 p
Avail: Univ. Microfilms Order No. 7916760

The propagation of plant harmonic waves in an infinite isotropic medium in which a doubly periodic array of cylindrical voids or fibers is embedded was studied. In the porous medium case, the matrix material is taken to be elastic, whereas for the fiber reinforcing it is taken to be viscoelastic. The direction of propagation is perpendicular to the fibers. Such geometries are not tractable analytically and a goal of the study was to see if recent developments in computational methods and algorithms made such problems within the framework of limited budgets. In both cases a finite element method based on Galerkin's technique was employed. Also, use was made of Floquet theory. Dissert. Abstr.

N79-29539 Virginia Polytechnic Inst. and State Univ., Blacksburg.
STRESS INTENSITY DISTRIBUTION FOR SURFACE FLAWS UNDER MIXED MODE LOADING Ph.D. Thesis
Arsavir Takfor Andonian 1978 75 p
Avail: Univ. Microfilms Order No. 7917394

A technique for obtaining values of the stress intensity factor from photoelastic data for part circular surface cracks under mixed mode loading is described. The method gives the stress intensity factor distributions around these flaw borders. The shift in the point of maximum stress intensity factor away from the point of maximum flaw penetration is found to be a real and consistently observed effect. Replications of identical test geometries indicate a scatter of the stress intensity factor determination of less than + or - 12 percent. Implications of results for numerical analysts and designers are presented. Dissert. Abstr.

N79-29540 Virginia Univ., Charlottesville.
ELASTOSTATIC STRESS ANALYSIS OF HIGHLY CURVED STRUCTURAL MEMBERS Ph.D. Thesis
Chirasak Thasanatorn 1978 184 p
Avail: Univ. Microfilms Order No. 7916324

Mathematical formulations and numerical solution techniques are presented for the elastostatic stress analysis of a highly-curved structural member with an arbitrary cross section subject to three types of forces. The applied forces include uniform torsion, direct (or transverse) shear and those due to warping constraints. The formulations are based on the theory of elasticity in which stresses are expressed in terms of stress functions and displacement (warping) functions. Reasonable assumptions permit the three-dimensional elasticity problem to be reduced to a two-dimensional problem for determining stresses on the cross section. Numerical results are obtained using the finite element method. Several curved structural members with various cross-sectional configurations and degrees of curvature are analyzed to illustrate the effects of initial curvature on the stress distribution. Dissert. Abstr.

N79-29541# National Aerospace Lab., Emmeloord (Netherlands).
HEAT TREATMENT STUDIES OF ALUMINUM ALLOY FORGINGS OF THE AZ 74.61 TYPE. FATIGUE CRACK PROPAGATION PERFORMANCE UNDER MANOEUVRE SPECTRUM LOADING
L. Schra, H. P. vanLeeuwen, and A. E. Meulman Aug. 1976 52 p refs
(NLR-TR-76074-U; ICAF-979; IR-3) Avail: NTIS HC A04/MF A01

The fatigue crack propagation performance of the alloy AZ 74.61 under maneuver spectrum loading was studied. The crack propagation behavior was also compared with that of the American forging alloy AA 7050, not only for simulated maneuver loading but also for simulated gust loading and program loading. It was found that, at comparable strength, the alloy AA 7050 was superior to AZ 74.61. Macro-fractographic observations revealed that the crack propagation behavior differed with respect to heat treatment, type of the load spectrum and specimen type. These observations emphasize the complexity of fatigue damage accumulation under variable amplitude loading. Author

N79-29542# Technion - Israel Inst. of Tech., Haifa. Dept. of Aeronautical Engineering.
COMPARISON OF FATIGUE BEHAVIOUR OF 2024-T3 AND 7075-T6 Al-ALLOY LUGS, PART 1
Alfred Buch May 1979 20 p refs
(TAE-365) Avail: NTIS HC A02/MF A01

Fatigue properties were compared for lugs made from Al-alloys 2024-T3 and 7075-T6 in cases of pin-lug joints with and without interference fit. Constant-amplitude test results obtained for lugs with interference fit. Constant-amplitude test results obtained for lugs with interference fit delta/d = 0.3 percent indicated superior fatigue properties for the 7075-T6 alloy. Gust spectrum tests performed in NLR on lugs without interference fit similarly indicated longer fatigue lives (N sub flights) for 7075-T6 lugs in the case of mean flight stresses sigma sub m greater than or equal to 115 N/m sq m. The Relative Miner Rule was used for comparison of LBF spectrum test results for AlZuMgCuAg - lugs with similar NLR test results for 7075-T6 lugs. Author

N79-29543# Technische Hogeschool, Delft (Netherlands). Dept. of Aerospace Engineering.
FATIGUE PROPERTIES OF ADHESIVE-BONDED LAMINATED SHEET MATERIAL OF ALUMINUM ALLOYS
J. Schijve, H. T. M. vanLipzig, G. F. J. A. vanGestel, and A. H. W. Hoeymakers Dec. 1978 41 p refs
(LR-276; ICAF-1086) Avail: NTIS HC A03/MF A01

Comparative fatigue tests were carried out on centrally cracked specimens and lug type specimens, both made from solid sheet and laminated sheet, consisting of five 1 mm sheets of 2024-T3 Alclad material bonded by FM 123/5. Most tests were carried out under constant amplitude loading but growth delays due to peak loads were studied also. Observations are made for through cracks and part through cracks. The significance of the results for application in aircraft structures is analyzed. Author

N79-29544# National Aerospace Lab., Emmeloord (Netherlands).
THE EFFECTS OF GUST ALLEVIATION ON FATIGUE IN 2024-T3 ALCLAD
J. B. deJonge, A. Nederveen, and P. J. Tromp 13 Jun. 1978 47 p refs
(NRL-TR-78064-U; ICAF-1059) Avail: NTIS HC A03/MF A01

Fatigue tests under flight simulation loading were done on simple notched 2024-T3 Alclad sheet specimens. Reduction of the gust load amplitudes resulted in an increase of crack initiation life but hardly influenced crack propagation. Reduction of the overall stress level increased both initiation and crack propagation life. The observed variations could be analytically predicted with varying success. Author

N79-29545# Aeronautical Research Labs., Melbourne (Australia).
RELIABILITY AND STRUCTURAL FATIGUE IN ONE-CRACK MODELS

D. G. Ford Jul. 1978 23 p refs
(ARL/Struc-Rept-369; AR-001-285) Avail: NTIS HC A02/MF A01

A structural fatigue model that allows for attrition due to collapse, war damage, hijacking, etc. in one-crack structure is presented. Attrition adds a single term to the Fokker-Planck equation. The model simplifies the reliability computation and elucidates the interaction of fatigue, inspection, ultimate loads, and other risks. K.L.

N79-29546# Laboratorium fuer Betriebsfestigkeit, Darmstadt (West Germany).

PROBLEMS OF RESEARCH IN THE FIELD OF STRUCTURAL FATIGUE

Otto Buxbaum 1977 11 p refs In GERMAN; ENGLISH summary
(ICAF-981) Avail: NTIS HC A02/MF A01

The development of theoretical and experimental methods and the production of data, with which machines, equipment, vehicles, and buildings can be designed such that they are able to resist all loads and other relevant environmental effects occurring during their estimated service life are presented. In order to design structures without unnecessary expenditure of material and effort, the operational loads were defined, the allowable stresses of the materials investigated, and the ability of the materials to resist the local stress and strain histories at critical points of the structure were determined. M.M.M.

N79-29547# Oakland Univ., Rochester, Mich. School of Engineering.

DETERMINATION OF STRAINS IN PHOTOELASTIC COATINGS

A. J. Durelli and K. Rajaiah May 1979 49 p refs
(Contract N00014-76-C-0487; Grant NSF ENG-77-07974)
(AD-A068265; Rept-51) Avail: NTIS HC A03/MF A01 CSCL 11/3

Photoelastic coatings can be cemented directly to actual structural components and tested under field conditions. This important advantage has made them relatively popular in industry. The information obtained, however, may be misinterpreted and lead to serious errors. A correct interpretation requires the separation of the principal strains and so far, this operation has been found very difficult. Following a previous paper by one of the authors, it is proposed to drill small holes in the coating and record the birefringence at points removed from the edge of the holes. The theoretical background of the method is reviewed; the technique necessary to use it is explained and two applications are described. The precision of the method is evaluated and found satisfactory in contradiction to information previously published in the literature. GRA

N79-29548# Illinois Univ. at Urbana-Champaign. Dept. of Civil Engineering.

BOUNDARY INTEGRAL EQUATION SOLUTION OF PLANE ELASTICITY PROBLEMS WITH HIGH STRESS CONCENTRATIONS

Hassan Nikooyeh and Arthur R. Robinson Apr. 1979 143 p refs
(Contract N00014-75-C-0164)
(AD-A069113; UILU-ENG-79-2005; SRS-461) Avail: NTIS HC A07/MF A01 CSCL 13/13

A numerical method for determination of stresses in two-dimensional elastic bodies with high stress concentrations is presented. Major emphasis is placed on bodies with a notch having a fillet of small radius and bodies with a crack of small width. These static boundary value problems are formulated in terms of boundary integral equations of a type used previously by Barone and Robinson for sharp notches and cracks. For the fillet problem a small inner region containing the fillet and bounded by a circle is separated out and analyzed numerically under the loading system of each of the Williams' solution of the corresponding sharp notch. The results are then used to develop analytical solutions for the intermediate region adjacent to the fillet region. In this way the details of the boundary configuration of the fillet is reflected in a set of generalized displacements which characterize the intermediate field. GRA

N79-29549# Stanford Univ., Calif. Dept. of Computer Science.

SACON: A KNOWLEDGE-BASED CONSULTANT FOR STRUCTURAL ANALYSIS

James Bennett, Lewis Creary, Robert Englemore, and Robert Melosh Sep. 1978 69 p refs
(Contracts DAHC15-73-C-0435; MDA903-77-C-0322)
(AD-A068539; SU-STAN-CS-78-699; HPP-78-23) Avail: NTIS HC A04/MF A01 CSCL 13/13

In this report we describe an application of artificial intelligence (AI) methods to structural analysis. We describe the development and (partial) implementation of an 'automated consultant' to advise non-expert engineers in the use of a general-purpose structural analysis program. The analysis program numerically simualtes the behavior of a physical structure subjected to various mechanical loading conditions. The automated consultant, called SACON (Structural Analysis Consultant), is based on a version of the MYCIN program (Shortliffe 74) originally developed to advise physicians in the diagnosis and treatment of infectious diseases. The domain-specific knowledge in MYCIN is represented as situation-action rules, and is kept independent of the 'inference engine' that uses the rules. By substituting structural engineering knowledge for the medical knowledge, the program was converted easily from the domain of infectious diseases to the domain of structural analysis. GRA

N79-29550# Air Force Materials Lab., Wright-Patterson AFB, Ohio.

RESIDUAL SURFACE STRAIN DISTRIBUTIONS NEAR HOLES WHICH ARE COLDWORKED TO VARIOUS DEGREES Final Report, Oct. 1975 - Sep. 1976

Gary Cloud Nov. 1978 231 p refs
(AF Proj. 2307)
(AD-A068396; AFML-TR-78-153) Avail: NTIS HC A11/MF A01 CSCL 20/11

Residual surface strain distributions were measured in the vicinity of holes in 1/4 in. aluminum alloy plate which had been coldworked to various degrees of by a commercial process. Seven levels of coldworking between 3.8 mils and 7.8 mils radial interference were studied. Attention focused mainly on radial strains, but hoop strains were measured for two coldwork levels. A sophisticated moire technique was developed for this investigation, and refined computer routines were utilized for reduction of data and plotting of results. The moire method involved high-resolution photography of a specimen grating before and after coldworking and subsequent generation of fringe patterns in a coherent optical processor. This report contains considerable tutorial detail about these techniques. The results are quite straightforward, and they are shown to agree reasonably well with the limited available data. The plastic deformation process appears to be quite complex, and minor changes of cold-working parameters can cause large changes in the strain--a factor which must be considered by designer and manufacturer. GRA

N79-29551# Army Engineer Waterways Experiment Station, Vicksburg, Miss.

VERIFICATION OF TEMPERATURE AND THERMAL STRESS ANALYSIS COMPUTER PROGRAMS FOR MASS CONCRETE STRUCTURES Final Report

Tony C. Liu, Roy L. Campbell, and Anthony A. Bombich Mar. 1979 111 p refs
(AD-A069376; WES-MP-SL-79-7) Avail: NTIS HC A06/MF A01 CSCL 13/13

The purpose of this investigation was to validate the accuracy and effectiveness of the temperature and thermal stress/strain calculation program currently being used by the Corps of Engineers by comparing analytical results with measured data obtained from embedded gages in Dworshak Dam. History of construction, weather data, and available material properties of Dworshak Dam were used for computer program input. Based on the results of this investgation, it can be concluded that the temperature and thermal stress calculation programs currently being used by the Corps are acceptable. Recommendations for further improvement of these computer programs are presented. GRA

N79-29552# California Univ., San Diego, La Jolla. Dept. of Applied Mechanics and Engineering Sciences.

ON THE TRANSVERSE TWISTING OF SHALLOW SPHERI-

CAL RING CAPS
May 1979 19 p refs
(Contract N00014-75-C-0158)
(AD-A069642) Avail: NTIS HC A02/MF A01 CSCL 20/11

The problem of transverse twisting of a shallow spherical shell with a small circular hole is solved, in generalization of the corresponding problem of a flat plate. The solution is of interest as a closed-form solution of an unsymmetrical stress concentration problem, with quantitative features depending on its boundary layer behavior for large values of a relevant parameter. The problem is also of interest as an example of the applicability of a previously proposed asymptotic procedure where interior contributions and edge-zone contributions are determined in sequence rather than simultaneously. GRA

N79-29553# California Univ., San Diego, La Jolla. Dept. of Applied Mechanics and Engineering Sciences.
NOTE ON A NON-TRIVIAL SIMPLE EXAMPLE OF HIGHER-ORDER ONE-DIMENSIONAL BEAM THEORY
E. Reissner Apr. 1979 17 p refs
(Contract N00014-75-C-0158)
(AD-A069641) Avail: NTIS HC A02/MF A01 CSCL 20/11

One-dimensional beam equations are derived for a rectangular-cross section beam consisting of shear webs and corner stringers with one cross-sectional axis of symmetry. It is shown that a systematic statement of this problem involves one more equation than elementary theory, with this additional equation involving the concept of cross-sectional warping and bi-moment. As an application of the general results of the paper, new conclusions are deduced concerning the location of the center of shear of the beam. GRA

N79-29554# Brown Univ., Providence, R. I. Div. of Engineering.
MECHANICS OF QUASI-STATIC CRACK GROWTH
James R. Rice Oct. 1978 73 p refs Presented at 8th Natl. Congr. of Appl. Mech., Los Angeles, 26 Jun. 1978
(Contract EY-76-S-02-3084)
(COO-3084-63; Conf-780608-3) Avail: NTIS HC A04/MF A01

Results on the mechanics of quasi-static crack are reviewed. These include recent studies on the geometry and stability of crack paths in elastic brittle solids, and on the thermodynamics of Griffith cracking, including environmental effects. The relation of crack growth criteria to nonelastic rheological models is considered and paradoxes with energy balance approaches, based on singular crack models, are discussed for visco-elastic, diffuso-elastic, and elastic-plastic materials. Also, recent approaches to prediction of stable crack growth in ductile, elastic-plastic solids are discussed. DOE

N79-29555# Sandia Labs., Albuquerque, N. Mex.
ESTIMATING MODAL DAMPING: A SURVEY
D. E. Miller 1979 9 p refs
(Contract EY-76-C-04-0789)
(SAND-79-0793C) Avail: NTIS HC A02/MF A01

A brief overview of some of the methods currently being utilized to estimate modal damping ratios is presented. Included are classic methods such as Nyquist plots, logarithmic decrement, and half-power frequency response methods. In addition, a few methods which were recently developed in an effort to overcome the limitations of the classic methods are presented. DOE

N79-29556# California Univ., Livermore. Lawrence Livermore Lab.
COMPUTER MODEL FOR DUCTILE FRACTURE: APPLICATIONS TO THE CHARPY V-NOTCH TEST, PHASE ONE
D. M. Norris, Jr., J. E. Reaugh, B. Moran, and D. F. Quinones Jan. 1979 117 p refs
(Contract W-7405-eng-48)
(EPRI-NP-961) Avail: NTIS HC A06/MF A01

A computer model for predicting ductile-fracture initiation and propagation in nuclear reactor pressure vessel steel is described. The model predicts fracture toughness from Charpy and tension tests using standard surveillance specimens. The fracture model is based on plastic strain. The computer fracture model is calibrated by computer simulation of simple and notched round-bar tension tests and a precracked compact tension test of A533 Grade B Class 1 steel and two different heat treatments of this steel. The model is used to predict fracture initiation and flat propagation in the standard Charpy V-notch specimen. A correlation is presented between the energy in the Charpy V-notch specimen at fracture initiation on the upper shelf and fracture toughness as measured by J/sub Ic/. DOE

N79-29557# Addis Translations International, Portola Valley, Calif.
OPTIMIZATION OF CERTAIN PARAMETERS OF AN ACOUSTIC MONITORING SYSTEM FOR STRUCTURES
D. P. Krasilnikov and V. V. Shemyakin Dec. 1978 35 p refs Transl. into ENGLISH of rept. IAE-2948 from Kurchatov Atomic Energy Inst., Moscow, 1978 21 p Prepared for Calif. Univ., Livermore. Lawrence Livermore Lab.
(UCRL-Trans-11441; IAE-2948) Avail: NTIS HC A03/MF A01

Problems related to acoustic emission testing are examined. These include: the optimization of the amplitude threshold; the operating frequency of the receiving circuit; the radius of coverage of the surface monitored by a group of four transducers; and the base distance of the group of transducers from the standpoint of maximizing the probability that acoustic emission signals will be passed into the measuring and analyzing section of the system in the presence of fluctuation noise. DOE

N79-29558# Battelle Columbus Labs., Ohio.
RESIDUAL STRESSES DUE TO WELD REPAIRS, CLADDING AND ELECTRON BEAM WELDS AND EFFECT OF RESIDUAL STRESSES ON FRACTURE BEHAVIOR Annual Report, 1 Sep. 1977 - 30 Nov. 1978
E. F. Rybicki Nov. 1978 188 p refs
(Contract AT(49-24)-0293)
(NUREG-CR-0559; BMI-2012) Avail: NTIS HC A09/MF A01

The study is divided into three tasks. Task 1 is concerned with predicting and understanding the effects of residual stresses due to weld repairs of pressure vessels. Task 2 examines residual stresses due to an electron beam weld. Task 3 addresses the problem of residual stresses produced by weld cladding at a nozzle vessel intersection. DOE

N79-29559# Centre Technique des Industries Mecaniques, St. Denis (France).
LINEAR MECHANICS OF FRACTURE. A DYNAMIC METHOD FOR DETERMINING THE LIMIT OF THE INTENSITY FACTOR Final Report [MECANIQUE LINEAIRE DE LA RUPTURE. DETERMINATION DU FACTEUR D'INTENSITE DE CONTRAINTE PAR UNE METHODE DYNAMIQUE]
C. Bouhelier, Y. Marez, and M. Courcot 7 Apr. 1978 36 p refs In FRENCH
(CETIM-1-5A-09-0) Avail: NTIS HC A03/MF A01

An instrumented Charpy impact test was used to analyze fracture phenomena in ISO steel test specimens in order to determine the influence of chemical composition and microstructure on fracture modes. Both classic fracture tests and fatigue tests using low energy repeated shock were conducted. Tests results are especially interesting in analyzing steels subjected to a cementite treatment. The adaptation of the charpy test setup to various dynamic test applications is discussed. Theoretical descriptions are supplemented by graphic displays of actual results. A bibliography is also included. Author (ESA)

N79-29560# Centre de Recherches Scientifiques et Techniques de l'Industrie des Fabrications Metalliques, Brussels (Belgium). Sect. Construction Metallique.
MAXIMUM PLASTIC RESISTANCE OF AN I BEAM WITH REINFORCED WEB SUBJECTED TO FLEXING AND SHEAR STRESS [RESISTANCE PLASTIQUE MAXIMUM D'UNE POUTRE EN DOUBLE TE A AME RENFORCE SOUMISE A FLEXION ET CISAILLEMENT]
Charles Massonnet (Liege Univ.), Dang Hung Nguyen (Liege Univ.), Azarius Dobruszkes (S.A. Preflex), and Jose Janss Sep. 1978 78 p refs In FRENCH Sponsored by Inst. de Rech. Sci. pour l'Ind. et l'Agr.
(CRIF-MT-126) Avail: NTIS HC A05/MF A01

The yield points of four different I beams subjected to flexing and shear stresses at ambiant laboratory temperature were

determined both theoretically and experimentally. The effect of web reinforcing on plastic resistance was also studied. Theoretical results were obtained with three independent calculation methods and were compared for accuracy with experimental results. The computation performances are quantitatively reported. Both theoretical and experimental results confirm that web reinforcing improves the plastic properties of I beams. However, due to the small specimen population no statistical conclusions on the relation of loading moments to yield points can be drawn with an acceptable level of confidence. Author (ESA)

N79-29561# Centre de Recherches Scientifiques et Techniques de l'Industrie des Fabrications Metalliques, Brussels (Belgium). Sect. Construction Metallique.

EXTERNAL LOADING ON NOZZLES IN CYLINDRICAL SHELLS Second Progress Report

Joris Decock Dec. 1978 45 p refs Sponsored by Inst. de Rech. Sci. pour l'Ind. et l'Agr.

(CRIF-MT-128) Avail: NTIS HC A03/MF A01

Experimental elastic stress studies were carried out on a nozzle type in cylindrical shell test vessels. Results obtained on two tests vessels are presented. A comparison is made with results from a previously presented design method. Strains were recorded at different loading levels both during loading and unloading. Seven different static loading states were used. Correlation of experimental data with the design method is better than in previous reports. Author (ESA)

N79-29562# Royal Aircraft Establishment, Farnborough (England).

AN ANALYSIS OF A PROGRAMMED LOAD FATIGUE FAILURE

C. J. Peel 14 Jul. 1978 29 p refs

(RAE-TR-78078; BR65871) Avail: NTIS HC A03/MF A01

Premature failure of an undercarriage fitting occurred during a fatigue test, in which the cylindrical barrel of the undercarriage was internally pressurized in a programmed sequence of pressures representing landing and taxying loads. Failure occurred by the initiation of fatigue cracks at defects in the undercarraige forging and by their growth to a critical depth. An effective pressure range was calculated by comparison of the fatigue striation spacings with laboratory crack growth data. It was assumed that one cycle of the effective pressure range would proceed at the same rate of crack growth as an entire sequence of pressurizations. The effective pressure range was used to predict the fatigue life of a defect free undercarriage by reference to the pressure-fatigue life data in the literature. It was found, by this means, that the metallurgical defects had reduced the life of the cylinder by a factor of at least 6 and that they had an effective stress concentration factor in fatigue of approximately 2. The predicted crack growth rate underestimated that observed by a factor of between 2 and 3, but this analysis revealed the damaging nature of small fluctuations, in pressure, about a high mean value. Author (ESA)

42 GEOSCIENCES (GENERAL)

No abstracts in this category.

43 EARTH RESOURCES

Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.

For instrumentation see *35 Instrumentation and Photography*.

N79-29563 British Library Lending Div., Boston Spa (England).

VISUAL ERGONOMICS IN CARTOGRAPHIC AND LITHOGRAPHIC WORK AT THE TOPOGRAPHIC SERVICE. PART 1: OPTOMETRIC ASPECTS AND VISUAL REQUIREMENTS

J. Boogaard, K. A. deVries, E. Ellens, and H. J. Leebeek Sep. 1978 24 p refs Transl. into ENGLISH of "Visuele Ergonomie bij Kartografische en Lithografische Werkzaamheden op de Topografische Dienst. Peel 1: Optometrische Aspekten en Visuele Eisen" Rept-1978-14, Inst. voor Zintuigfysiologie, Netherlands (BLL-RAE-Trans-1988-(5207); RAE-Lib-Trans-1988; BR67113) Avail: British Library Lending Div., Boston Spa, Engl.

The job situation of cartographers and lithographers was found to be improved by providing special working glasses. Visual standards were formulated to be used when applicants for jobs are examined medically or in the case of re-examination of cartographic operators. R.E.S.

N79-29564 Delaware Univ., Newark.

A TWO-LEVEL WEIGHTED FACTOR EVALUATION OF THE METALLIC MINERALIZATION POTENTIAL OF CENTRAL BAJA CALIFORNIA USING SATELLITE DATA AND COMPUTER-ASSISTED ENHANCEMENT TECHNIQUES Ph.D. Thesis

Ralph Norbert Baker 1979 339 p

Avail: Univ. Microfilms Order No. 7918796

Remote sensor data (primarily LANDSAT) were analyzed by photogeologic and computer-assisted enhancement techniques to evaluate the metallic mineral potential of Baja California. Overlays were prepared at 1:1,000,000 and 1:500,000 and included known geologic relationships and mineral occurrences; lineament, drainage and structural patterns; tonal anomalies; and results of computer-assisted extractive processing. Computer-assisted enhancement and classification of the test sites was performed using multispectral image analysis system to identify subtle tonal anomalies thought related to mineralization using known sites as analysis guides. The probability for mineralization within the entire central Baja California study area was quantified using a weighted factor approach. Mineral potential maps of Baja California were generated from these analyses. Dissert. Abstr.

N79-29565 Stanford Univ., Calif.

QUANTITATIVE RELATIONSHIPS OF SURFACE GEOLOGY AND SPECTRAL HABIT TO SATELLITE RADIOMETRIC DATA Ph.D. Thesis

Stuart Emmet Marsh 1979 290 p

Avail: Univ. Microfilms Order No. 7917258

Integrating the sampling, correlation, and mixture research established the quantitative accuracy of the LANDSAT multispectral data for a variety of geologic terrains. Within defined contrast constraints, and after compensation is made for atmospheric attenuation and scattering, the system can accurately depict the spectral character of the Earth's surface. Dissert. Abstr.

N79-29566 Oregon Univ., Eugene.

WATER AND ENERGY RESOURCE DEVELOPMENT IN THE TONGUE RIVER BASIN, SOUTHEASTERN MONTANA Ph.D. Thesis

David Hunter Hickcox 1979 383 p

Avail: Univ. Microfilms Order No. 7918722

Water use, water availability, and energy development from the perspective of historical-cultural geography, physical geography, and resource management are examined. Water has been the key to the settlement and economy of the Tongue River Basin and is the key to future development of the basin. Massive development of the basin's coal resources which can alter the basin's hydrologic systems and traditional means of livelihood are discussed. Dissert. Abstr.

N79-29567 Delaware Univ., Newark.

SPECTRAL REFLECTANCE OF TIDAL WETLAND PLANT CANOPIES AND IMPLICATIONS FOR REMOTE SENSING Ph.D. Thesis

David Scott Bartlett 1979 253 p

Avail: Univ. Microfilms Order No. 7918797

In order to assess the potential for extending quantitative remote sensing capabilities into collection of data on tidal wetlands an investigation was carried out in Delaware with particular emphasis on application of Landsat/MSS data. Spectral contrast between S. alterniflora and Salt Hay (a mixed category containing S. patens and D. spicata) depended primarily on

species-specific differences in the amount and growth form of vegetation. Contrast was seasonally variable and was controlled by a variety of factors related to canopy composition and structure. It was determined that potential exists for use of spectral data in estimating mean green and total biomass for areas of S. alterniflora using either hand-held instruments in the field or Landsat/MSS data. Dissert. Abstr.

N79-29568*# Environmental Sensing Algorithm Development Co., Sunland, Calif.
EVALUATION AND ANALYSIS OF SEASAT-A SCANNING MULTICHANNEL MICROWAVE RADIOMETER (SSMR) ANTENNA PATTERN CORRECTION (APC) ALGORITHM. SUB-TASK 4: INTERIM MODE T SUB B VERSUS CROSS AND NOMINAL MODE T SUB B Final Report
J. L. Kitzis and S. N. Kitzis 27 Jul. 1979 122 p ref Prepared for JPL
(Contracts NAS7-100; JPL-955368)
(NASA-CR-158865) Avail: NTIS HC A06/MF A01 CSCL 05B

The brightness temperature data produced by the SMMR Antenna Pattern Correction algorithm are evaluated. The evaluation consists of: (1) a direct comparison of the outputs of the interim, cross, and nominal APC modes; (2) a refinement of the previously determined cos beta estimates; and (3) a comparison of the world brightness temperature (T sub B) map with actual SMMR measurements. K.L.

N79-29569# Forest Service, Vernal, Utah.
HIGH UINTAS SOUTH SLOPE LAND MANAGEMENT PLAN AND FINAL ENVIRONMENTAL STATEMENT
Mar. 1979 532 p refs Original contains color illustrations
Avail: NTIS HC A23/MF A01

Management alternatives for the High Uintas South Slope and Roadless Area were considered. The principal issues were the coordination of management with the Central Utah Project and the designation of roadless areas to be managed for their wilderness values. The selected alternative calls for developments of recreation facilities around the Central Utah Project reservoirs in the canyon bottoms, and commodity production from the intervening plateaus. J.M.S.

N79-29570# Environmental Research Inst. of Michigan, Ann Arbor. Infrared and Optics Div.
STATISTICAL ANALYSES OF TERRAIN DATA Final Report
Anthony J. Larocca and J. Robert Maxwell Feb. 1979 246 p refs
(Contract N60530-78-C-0009)
(AD-A068389; ERIM-132300-2-F) Avail: NTIS HC A11/MF A01 CSCL 08/7

Data on various terrain backgrounds were collected and analyzed to present their statistical features. Some of those characteristics are described in the form of histograms, ellipse 'pictures,' and power spectra for the following infrared spectral bands: 2.0 - 2.6, 3.0 - 4.2, 3.5 - 3.9, 3.9 - 4.7, 4.5 - 5.5, 5.1 - 5.7, and 9.0 - 11.4 micrometers. An attempt is made to demonstrate various meteorological and other influences on the statistics by comparing the data in different spectral regions taken at different times and under differing conditions. Using these results and those from future analyses of other scenery, one would hope eventually to be able to categorize terrain backgrounds according to a few recognizable parameters. GRA

N79-29571# Rome Research Corp., N. Y.
RECONNAISSANCE SENSOR SYSTEM EXPLOITATION Final Technical Report, 1 Sep. 1976 - 31 Nov. 1978
Richard R. Petroski Griffiss AFB, N. Y. RADC Mar. 1979 256 p
(Contract F30602-76-C-0431; AF Proj. 6244)
(AD-A069013; RRC-78-4; RADC-TR-79-32) Avail: NTIS HC A12/MF A01 CSCL 14/5

Documented in this report are the primary tasks accomplished under the project titled, 'Reconnaissance Sensor System Exploitation'. It is intended to present a brief summary of the sensor evaluations and exploitation of reconnaissance equipment and techniques performed under the program. Support provided in the RADC/IRR Reconnaissance Data Base along with the support provided by the Northeast Test Area (NETA) is also included. A brief description of the programs that were supported at the Military Equipment Display and Engineering Area (Stockbridge Test Annex) offer the reader a summary of the equipment and support available to reconnaissance sensor test programs. Detailed information on any of the efforts completed during the contract may be obtained from RADC/IRRE, Griffiss AFB NY 13441. GRA

N79-29572# Army Engineer Topographic Labs., Fort Belvoir, Va.
TERRAIN ANALYSIS PROCEDURAL GUIDE FOR VEGETATION
Jeffrey A. Messmore, Theodore C. Vogel, and Alexander R. Pearson Mar. 1979 215 p refs
(DA Proj. 4A7-62707-A-855)
(AD-A068715; ETL-0178) Avail: NTIS HC A10/MF A01 CSCL 08/6

This procedural guide provides the U.S. Army Terrain Analyst with the necessary step-by-step procedures to be used in generation of vegetation factor overlays and supportive data tables. Three potential sources of information on vegetation are considered: (1) military topographic maps, (2) literature, and (3) aerial imagery. Procedures are presented for each of 13 data elements that characterize vegetation of the geographic area of interest. The included appendixes provide the Terrain Analyst with additional reference information. GRA

N79-29573# Naval Research Lab., Washington, D. C.
REMOTE SENSING OF OCEAN SIGNIFICANT WAVE HEIGHT BY FORWARD SCATTERING: EXAMPLES FROM L-BAND DATA Final Report
C. I. Beard 18 Apr. 1979 92 p refs
(RR0310343)
(AD-A068337; NRL-MR-3968) Avail: NTIS HC A05/MF A01 CSCL 08/3

This is the final report of a series of three on measurements of 1.3-GHz (L-band) electromagnetic wave, forward reflection coefficients of the ocean. The L-band line-of-sight path was chosen between a transmitter in an aircraft flying at constant altitude towards receiving horns mounted on the stabilized platform of a destroyer. Six days of data were obtained by flights off the Atlantic Coast in 1974. Wave heights were measured by an airborne laser profilometer. The measured L-band forward reflection coefficients followed Ament's theoretical curve as a function of apparent surface roughness (sigma sub w sin psi)/lambda for the small roughnesses encountered (- or - 0.1). A remote sensing method for significant wave height emerges from 'recasting Ament's theoretical expression into a series of curves vs grazing angle (psi), with wave height (sigma sub w) as a parameter. Plotting the measured reflection coefficients on this graph then yields significant wave height (4 sigma sub w) directly. The average spread in the values of sigma sub w predicted by this method is - 0.12 ft for values of sigma sub w from 0.4 to 0.9 ft. An FM-sweep system is proposed which should improve this accuracy. GRA

N79-29574# Geological Survey, Reston, Va.
SHALE CHARACTERIZATION AND RESOURCE APPRAISAL OF THE DEVONIAN BLACK SHALES OF THE APPALACHIAN BASIN Quarterly Report, Apr. - Jun. 1978
W. DeWitt, Jr. 1978 21 p
(Contract EX-76-A-01-2287)
(FE-2287-T5) Avail: NTIS HC A02/MF A01

Activities are reported in a program to characterize the gas-productive black shales and related rocks of Middle and Late Devonian age in the Appalachian basin by use of stratigraphic, paleontologic, geochemical, mineralogic, and geophysical data; to assist DOE--MERC by coordinating and evaluating stratigraphic work in shale characterization studies by other DOE--Eastern Gas Shales Cooperation to the limit of available USGS personnel; to develop a data storage and retrieval system to store the data generated in the EGS project, to make a resource appraisal of the hydrocarbon potential of the Devonian black shales of the Appalachian basin using data generated in part by the USGS, in part by DOE--MERC and in part by EGS project contractors; to conduct work shops for other EGS project cooperators in stratigraphy, structure, geochemistry, and mineralogy as the EGS

project cooperators in stratigraphy, structure, geochemistry, and mineralogy as the occasion demands; and to assist in technology transfer by participating as panel-of-interest members at DOE--Industry meetings. DOE

N79-29575# Pullman Kellogg, Houston, Tex.
SOURCES AND DELIVERY OF CARBON DIOXIDE FOR ENHANCED OIL RECOVERY Final Report, Oct. 1977 - Dec. 1978
M. Hare, H. Perlich, R. Robinson, M. Shah, and F. Zimmerman
Dec. 1978 398 p refs
(Contract EX-76-C-01-2515)
(FE-2515-24) Avail: NTIS HC A17/MF A01

The carbon dioxide supply situation for miscible flooding operations to enhance oil recovery (EOR) is presented. The carbon dioxide sources within the geographic areas of potential EOR are shown on four regional maps with the tabular data for each region describing the sources in terms of quantity and quality. Evaluation of all the costs, such as purchase, production, processing, and transportation, associated with delivering the carbon dioxide from its source to its destination are presented. DOE

N79-29576# Mathematica, Inc., Princeton, N. J.
OIL SHALE: REPORT ON A FOCUS GROUP DISCUSSION
G. R. Christophersen 10 Nov. 1978 47 p refs
(Contract EV-78-C-01-6388)
(DOE/TIC-10032) Avail: NTIS HC A03/MF A01

The panel discussion focused on four types of barriers to oil shale commercialization including technological, economic, institutional, and environmental. The discussants agreed that both the size and potential demand for syncrude are massive. It was agreed that if this nation is to develop a domestic industry which is to produce liquid hydrocarbons as an energy source, the commercialization of the oil shale industry is important. Oil shale is viewed as the most economical option for domestic syncrude. Industry representatives share a strong optimism that an environmentally acceptable technology can be developed that will be economically attractive to industry. The environmentalists are concerned that as of yet no such environmentally acceptable technology exists. DOE

N79-29577# Mathematica, Inc., Princeton, N. J.
ENHANCED OIL RECOVERY: REPORT ON A FOCUS GROUP DISCUSSION
Irving Crespi 10 Nov. 1978 40 p refs
(Contract EV-78-C-01-6388)
(DOE/TIC-10021) Avail: NTIS HC A03/MF A01

A qualitative assessment is presented of the dimensions of opinion concerning the commercialization potential of enhanced oil recovery. There was a group consensus that commercialization of EOR is contingent on the existence of financial incentives, primarily in the form of prices which will make EOR attractive for capital investment. A second prerequisite is loan guarantees to reduce the risk inherent in technologies that are still in the process of being developed. It was felt that tax credits would be an effective incentive. Current price regulations, and what appears to be a trend of DOE to resolve issues case by case rather than through standard rules, were considered to be disincentives to commercialization. DOE

N79-29578# Market Facts, Inc., Washington, D. C.
ENHANCE OIL RECOVERY: FOCUS GROUP RESULTS
Aug. 1978 37 p refs
(Contract EV-78-C-01-6458)
(DOE/TIC-100200) Avail: NTIS HC A03/MF A01

The research on the evaluation of the potential for commercialization of enhanced oil recovery, determination of the barriers to development of this resource, and evaluation of actions required by the federal government to promote commercialization are presented. Group agreement with the DOE assessment of EOR with some reasonably predictable difference in emphasis is reported. It was felt that price controls placed a particularly heavy burden on EOR not only because of the disincentive effect of the (then) current price (since the meeting the ERA has recommended a higher price for EOR oil), but because of the dislocation caused by two-tier pricing. DOE

N79-29579# Gruy Federal, Inc., Houston, Tex.
ASSESSMENT OF POTENTIAL INCREASED OIL PRODUCTION BY POLYMER-WATERFLOOD IN NORTHERN AND SOUTHERN MID-CONTINENT OIL FIELDS Progress Report, period ending 30 Sep. 1978
15 Oct. 1978 34 p refs
(Contract EW-78-C-19-0026)
(BETC-0026/4) Avail: NTIS HC A03/MF A01

Results of polymer-waterflood studies are reported. The Burbank-Bartlesville sand reservoir, located in the north half of the Stanley Stringer Field, Osage County, Oklahoma was studied. Progress is summarized in a chart. DOE

N79-29580# Texas Instruments, Inc., Dallas.
AERIAL RADIOMETRIC AND MAGNETIC RECONNAISSANCE SURVEY OF PORTIONS OF ARIZONA, NEW MEXICO. VOLUME 1: INSTRUMENTATION AND METHODS Final Report
Nov. 1978 63 p refs
(Contract EY-76-C-13-1664)
(GJBX-23(79)-Vol-1) Avail: NTIS HC A04/MF A01

Instrumentation and methods are described for a high-sensitivity, aerial gamma ray spectrometer and magnetometer survey of the Mesa, Tucson, Nogales, Clifton, Silver City, and Douglas, NTMS, 1:250,000-scale quadrangles in southeastern Arizona and southwestern New Mexico. A Bell 212 helicopter equipped with gamma ray spectrometer and six large-volume sodium iodide detectors, two 400 channel analyzers, and ancillary geophysical and electronic equipment, and a DC-3 aircraft equipped with nine detectors were used. Gamma ray spectrometric data were processed to correct for variations in atmospheric, flight, and instrument conditions and were statistically evaluated to remove the effects of surface geologic variations. The resulting first-priority uranium anomalies were interpreted to evaluate their origin and significance. Results in the form of a preferred anomaly map, along with significance-factor profile maps, stacked profiles, and histograms, are presented. DOE

N79-29581# Royal Netherlands Meteorological Inst., De Bilt.
GROUND WATER LYSIMETERS IN CASTRICUM. THE CALCULATION OF EVAPORATION FROM THE WATER BALANCE USING THE PENMAN EVAPORATION MODEL [WATERHUISHOUDING LYSIMETERS CASTRICUM 1967. EEN VERGELIJKING VAN D VERDAMPING BEREKENDUIT DE WATERBALANS MET DE VERDAMPING VOLGENS PENMAN]
J. Q. Keijman and W. Schipper 1978 31 p refs In DUTCH; ENGLISH summary
(KNMI-WR-78-5) Avail: NTIS HC A03/MF A01

During 1967 four lysimeters, previously built in the sand dunes near Castricum, were used to study the effects of different watersheds on soil moisture evaporation and drainage. The lysimeters consist of concrete boxes, 25 m wide, 25 m long, and 2.5 m deep. Each is provided with a drainage system for measuring daily rain water as well as being differently planted. One lysimeter is bare, the others contain natural dune vegetation, deciduous trees, and pines, respectively. Meteorological quantities were measured daily. Soil moisture measurements were made by a neutron diffraction method. Results show evaporation can be determined from the water balance with a reasonable accuracy for periods of 3 months or more. The influence of vegetation on evaporation is very clear if yearly totals are considered. Author (ESA)

N79-29582# National Weather Service, Silver Spring, Md. Office of Hydrology.
IMPROVEMENT OF HYDROLOGIC SIMULATION BY UTILIZING OBSERVED DISCHARGE AS AN INDIRECT INPUT COMPUTED HYDROGRAPH ADJUSTMENT TECHNIQUE (CHAT)
Walter T. Sittner and Kay M. Krouse Feb. 1979 151 p refs
(PB-295697/7; NOAA-TM-NWS-HYDRO-38;
NOAA-79042001) Avail: NTIS HC A08/MF A01 CSCL 08H

A computerized technique is presented where the output of a continuous conceptual hydrologic model is adjusted in real time to agree with the observations of discharge. Since the discharge generated by the model in response to a moisture input is dependent upon the current values of the state variables

of the model, the procedure also adjusts the state variables to correspond to the output. The technique is applicable to outflow from headwater catchments during runoff events that result from liquid precipitation. Its approarch is to make adjustments, iteratively and simultaneously, to the precipitation and the shape of the unit graph until the model produces a simulation that agrees, with resonable limits, with the discharge observations. Examples of the performance of the procedure under a variety of hydrologic conditions are included. GRA

N79-29583# Bureau of Mines, Denver, Colo. Intermountain Field Operation Center.
PROVIDING NEW SOURCES OF MINERAL SUPPLY
John Paul Gries 1979 48 p refs
(PB-294836/2; BM-IC-8789) Avail: NTIS HC A03/MF A01 CSCL 08I

A study by the bureau of mines outlines the history of 11 major metal ore deposits or districts that are relatively new discoveries. The oldest operation is the White Pine mine, where major exploration was initiated in 1929. Discovery (delineation of ore bodies) dates range from 1948 to 1976. All but two of the deposits, Quartz Hill in Alaska and Flambeau in Wisconsin, are in major production. DOE

N79-29584# Technicolor Graphic Services, Inc., Sioux Falls, S. Dak.
A SELECTED BIBLIOGRAPHY: REMOTE SENSING TECHNIQUES FOR EVALUATING THE EFFECTS OF SURFACE MINING
David M. Carneggie and Donald O. Ohlen 6 Mar. 1979 15 p refs
(Contract DI-14-08-0001-16439)
(PB-294299/3) Avail: NTIS HC A02/MF A01 CSCL 08I

Thirty-one citations of technical papers and other publications dealing with the monitoring surface mining are presented. These references summarize recent developments in methods used to identify, map, analyze, and monitor surface mining, particularly coal surface mining. GRA

N79-29585# National Oceanic and Atmospheric Administration, Ann Arbor, Mich. Great Lakes Environmental Research Lab.
EVAPORATION FROM LAKE ST. CLAIR
Jan A. Derecki Dec. 1978 40 p refs
(PB-295686/0; NOAA-TM-ERL-GLERL-23; NOAA-79042004) Avail: NTIS HC A03/MF A01 CSCL 08H

Available land-based data adjusted to overwater conditions were used to determine monthly evaporation from Lake St. Clair for individual years of a 26-year period, 1950-75, by the mass transfer method. Because of extensive ice cover on the lake, the overwater mass transfer results were adjusted for the ice cover during winter. The ice cover adjustment reduced the average annual evaporation by 100 mm, with a resultant average annual evaporation of 750 mm. The mass transfer method is the only technique that permits operational evaporation estimates from this lake with presently available data. GRA

N79-29586# Washington Univ., Seattle. Hydraulics Lab.
FORECASTING-SEASONAL SNOWMELT RUNOFF: A SUMMARY OF EXPERIENCE WITH TWO MODELS APPLIED TO THREE DRAINAGES IN THE CASCADE MOUNTAINS OF WASHINGTON
Dennis P. Lettenmaier and Terry J. Waddle Nov. 1978 109 p refs
(Contract DI-14-34-0001-7199)
(PB-294656/4; TR-59; W79-06047; OWRT-B-071-Wash(2)) Avail: NTIS HC A06/MF A01 CSCL 08H

Two alternative approaches to forecasting seasonal runoff volumes from watersheds with substantial snow storage were investigated. In the first, a continuous simulation model was applied to the Cedar River, Washington. The mode could not be successfully calibrated for use in forecasting Cedar River runoff. Problems were traced to the snowpack accumulation and ablation module of the model; adequate performace of the land module was observed. The second approach employed was a modification of a basin storage accounting approach, in which parameters are estimated by regression. The model was applied to three Washington streams: the Cedar, American, and Stehekin Rivers. GRA

N79-29587# Washington Univ., Seattle. Hydraulics Lab.
INCORPORATION OF FORECASTED SEASONAL RUNOFF VOLUMES INTO RESERVOIR MANAGEMENT
Stephen J. Burges and Kiyoshi Hoshi Nov. 1978 95 p refs
(Contract DI-14-34-0001-7199)
(PB-294655/6; W79-06048; OWRT-B-071-Wash(1); TR-58) Avail: NTIS HC A05/MF A01 CSCL 08H

Seasonal snowmelt runoff volume forecasting was examined to determine what methods of forecasting show the most provision for providing data for improving reservoir operations. The forecasting approaches can be classied as regression methods, pseudo water balance methods, and water balance methods; different approaches have different data demands and different forecast accuracies. Disaggregating predicted total seasonal runoff volumes to yield conditional probability distributions of flow in each month of the total forecast period is reported. These conditional distributions were used as principal input data to a reservoir operation model. GRA

N79-29588# Utah State Univ., Logan. Dept. of Civil and Environmental Engineering.
SALINITY TRANSPORT BETWEEN LAYERS OF A STRATIFIED SHEAR FLOW M.S. Thesis
Christopher J. Freitas Feb. 1979 71 p refs
(Contract DI-14-34-0001-7191)
(PB-294652; W79-06106; OWRT-B-139-UTAH(3)) Avail: NTIS HC A04/MF A01 CSCL 08H

The parameter relationships and the extent of entrainment occuring at the pycnocline within the southern arm of the Great Salt Lake were determined dealing with the two layer stratified system existing within the southern arm - an upper dilute brine layer over a lower dense brine layer. A model of interfacial conditions of the southern arm within a laboratory flume was made. Through the use of this apparatus the relationships between dimensionless numbers representing upward mixing, relative density difference and the Richardson number were determined. In addition, predictions of the magnitude of the entrainment rate per unit area, K, were established. GRA

N79-29589# North Carolina Water Resources Research Inst., Raleigh.
A WATER MANAGEMENT MODEL FOR SHALLOW WATER TABLE SOILS
R. W. Skaggs Nov. 1978 203 p refs
(Contract DI-14-34-0001-7070)
(PB-294641/6; UNC-WRRI-78-134; W79-06050; OWRT-A-086-NC(4)) Avail: NTIS HC A10/MF A01 CSCL 08H

Water management model, DRAINMOD, for shallow water table soils that normally require artificial drainage, for efficient crop production was developed. The model simulates on a day-to-day, hour-by-hour basis the table position, soil water content, drainage, evapotranspiration (ET) and surface runoff in terms of climatological data, soil properties, crop parameters, and the water management system design. The basis of the model is a soil water balance in the soil profile. It is composed of a number of separate subroutines including methods to evaluate infiltration, subsurface drainage, surface drainage, potential evapotranspiration ET, actual ET, subirrigation and soil-water distribution. GRA

N79-29590# Michigan State Univ., East Lansing. Inst. of Water Research.
EVALUATION OF GROUNDWATER FLOW AND RECHARGE THROUGH GLACIAL DRIFT. MICHIGAN STATE WATER QUALITY MANAGEMENT PROJECT, EAST LANSING, MICHIGAN Project Completion Report, 1 Apr. 1977 - 30 Sep. 1978
Grahame J. Larson Apr. 1979 71 p refs
(Contracts DI-14-31-0001-7048; DI-14-31-0001-8024)
(PB-294538/4; W79-05791; OWRT-A-095-Mich(1)) Avail: NTIS HC A04/MF A01 CSCL 08H

A geohydrologic study of glacial sediments underlying the spray irrigation site demonstrates that the site is underlain by both clay till deposits and interbedded gravel layers. Aquifer testing of the drift material indicates that the average transmissivity of the gravel units is approximately 4000 gpd/ft (50 cu m/d m), while the vertical permeability of the clay units averages

0.12 gpd/sq ft (5.7 x .001 cm/sec). Observed infiltration rates (0.07 gpd/sq ft) at the site appear to be twice the rate (0.03 gpd/sq ft) calculated from the aquifer test data. The difference in the infiltration rates is primarily attributed to downward flow of water along the permeable gravel layers, which are, to some degree, hydraulically connected to the underlying Saginaw Formation. GRA

N79-29591# Hawaii State Dept. of Planning and Economic Development, Honolulu. Land Use Div.
HAWAII'S RESOURCES: INVENTORY AND POLICIES. A PROTOTYPE DEMONSTRATION FOR THE ISLAND OF KAUAI Final Report
1978 155 p
(PB-294504/6) Avail: NTIS HC A08/MF A01 CSCL 13B

The State and Land Resources Policy Project had the objectives to develop: (1) policies for the preservation and management of Hawaii's resources; and (2) a resource base inventory (RBI) system to assist decision makers in implementing those policies. The RBI, in both its bibliographic and cartographic (resource map) demonstration versions for Kauai, should prove to be a valuable tool for resource planners, managers, and decision makers. GRA

44 ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells and batteries; global sources of energy; fossil fuels; geophysical conversion; hydroelectric power; and wind power.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *85 Urban Technology and Transportation.*

N79-29592 Emory Univ., Atlanta, Ga.
URBAN AREAS AS ENERGY FLOW SYSTEMS Ph.D. Thesis
Arwood James Ruttenber, Jr. 1979 371 p
Avail: Univ. Microfilms Order No. 7916058

The application of energy flow analysis to the study of urban dynamics is evaluated from both theoretical and methodological perspectives. The paradigm of energy flow is discussed in terms of its relevance to the fields of theoretical biology, systems ecology, cultural anthropology, evolutionism, regional planning theory, and general system theory. An energy flow modeling technique is described and compared with other modeling approaches. A detailed explanation of the computer simulation of energy flow models is also provided. Dissert. Abstr.

N79-29593 Wisconsin Univ. - Madison.
AN ASSESSMENT OF WIND CHARACTERISTICS AND WIND ENERGY SYSTEMS APPLICATIONS TO ELECTRIC UTILITIES IN WISCONSIN AND SECTIONS OF MINNESOTA, IOWA AND ILLINOIS Ph.D. Thesis
Carel Christiaan Dewinkel 1978 313 p
Avail: Univ. Microfilms Order No. 7902397

Wind speed data from the National Climatic Center were analyzed to assess the wind characteristics for the application of wind energy conversion systems (WECS) to electric utility. In addition, five Coast Guard Stations along the shores of Lakes Superior and Michigan were analyzed. WECS as part of an electric utility system can be evaluated by electric utility planning methods. The method of analysis employs predicted wind power output data, based on 5 years of wind speed observations, that are subtracted on an hourly basis from the predicted load levels. These adjusted hourly load levels serve as an input of a conventional production cost model. Savings in production costs over the lifetime of the WECS, minus the O & M, taxes and insurance costs of the WECS, result in the estimated break even capital cost of the WECS. Dissert. Abstr.

N79-29594 Virginia Univ., Charlottesville.
THE USE OF CHLOROPHYLL IN A NOVEL SOLAR BATTERY Ph.D. Thesis
James Christopher Ludlow 1978 85 p
Avail: Univ. Microfilms Order No. 7916266

A novel solar battery was developed, one which uses chlorophyll a for the generation of a current. The battery consisted of a platinum foil electrode, onto which a mixture of chlorophyll a and lipoic acid was deposited, and a platinum current collector. With such a device, voltages greater than 0.35 volts were reproducibly developed. The dependence of the output of the cell as a function of chlorophyll levels, carotenoid levels, and intensity and wavelength of the incident light was determined. It is felt that this solar cell which, in essence, mimics the action of the green leaf, offers promise as a photovoltaic device. Dissert. Abstr.

N79-29595 Washington Univ., Seattle.
A CONTROL SYSTEM ANALYSIS OF THE ENERGY GROWTH MODEL: COAL Ph.D. Thesis
Ole Arvid Bakken 1978 357 p
Avail: Univ. Microfilms Order No. 7917535

The application of optimal control theory to allow for maximum use of solar power, in concert with coal and nuclear, for the generation of electricity beyond 1990, with oil and gas having been phased out by 1990 is described and demonstrated. The literature search for a model resulted in the selection of the Dartmouth College model termed COAL. The model equations, written in DYNAMO simulation language, and illustrated by DYNAMO diagrams, are studied in detail, and then transformed into differential equations with associated flow diagrams. The electricity generation sector and the demand sector of this model, including a solar sector developed, are selected for detailed control system analysis. Three options for generating future electricity by solar are discussed, and numerical parameters for one option are incorporated into the computer simulation programs. Dissert. Abstr.

N79-29596 Commission of the European Communities, Brussels (Belgium).
ENERGY RESEARCH AND DEVELOPMENT PROGRAMME First Status Report, 1975 - 1976
Jul. 1977 389 p
(EUR-5889; ISBN-9-024-72059-1) Copyright. Avail: Issuing Activity

Details of work carried out under contract and within the scope of the research and development program adopted by the council of Ministers of the European Community on August 22, 1975, are presented. Headings under which individual projects are grouped include 'Energy Conversion', 'Production and Utilization of Hydrogen', 'Solar Energy', 'Geothermal Energy', and 'Systems Analysis' (development of models). Author (ESA)

N79-29597# Committee on Energy and Natural Resources (U.S. Senate).
ENERGY CONSERVATION AND REGULATION IN THE PRESIDENT'S BUDGET
Washington GPO 1978 399 p refs Hearing before the Subcomm. on Energy Conservation and Regulation of the Comm. on Energy and Natural Resources, 95th Congr., 2d Sess., 3 Mar. 1978
(GPO-25-418; Publ-95-139) Avail: Subcommittee on Energy Conservation and Regulation

The potential impact of the enactment of the National Energy Act on the manpower and budget requirements of the Department of Energy is examined. Funding for programs under the Assistant Secretary for Conservation and Solar Applications, the Economic Regulatory Administration, the Federal Energy Regulatory Commision, the Energy Information Administration, and the Director of Information is examined in testimony delivered and in written answers to specific questions supplied by members of the Committee. A.R.H.

N79-29598*# Motorola, Inc., Phoenix, Ariz.
SEMICONDUCTOR GRADE, SOLAR SILICON PURIFICATION PROJECT Final Report, Feb. 1976 - Jan. 1979
W. M. Ingle, R. S. Rosler, S. W. Thompson, and R. E. Chaney Jan. 1979 173 p refs Prepared for NASA and DOE
(Contract JPL-954442)
(NASA-CR-158868; Rept-2257/12; DOE/JPL-954442-78/12)

Avail: NTIS HC A08/MF A01 CSCL 10A

A low cost by-product, SiF4, is reacted with mg silicon to form SiF2 gas which is polymerized. The (SiF2)x polymer is heated forming volatile SixFy homologues which disproportionate on a silicon particle bed forming silicon and SiF4. The silicon analysis procedure relied heavily on mass spectroscopic and emission spectroscopic analysis. These analyses demonstrated that major purification had occured and some samples were indistinguishable from semiconductor grade silicon (except possibly for phosphorus). However, electrical analysis via crystal growth reveal that the product contains compensated phosphorus and boron. A.W.H.

N79-29599*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

DYNAMIC ANALYSIS OF A PHOTOVOLTAIC POWER SYSTEM WITH BATTERY STORAGE CAPABILITY Final Report

Walter C. Merrill, Ronald J. Blaha, and Roy L. Pickrell Jul. 1979 47 p ref

(DE-AI01-79ET20485)

(NASA-TM-79209; E-094; DOE/NASA/20485-79/4) Avail: NTIS HC A03/MF A01 CSCL 10C

A photovolataic power system with a battery storage capability is analyzed. A dual battery current control concept is proposed, which enables the battery to either supply or accept power depending upon system environment and load conditions. A simulation of the power system, including the battery current control, is developed and evaluated. The evaulation demonstrate the visbility of the battery control concept of switch the battery from a charge to discharge mode and back as required by load and environmental conditions. An acceptable system operation is demonstrated over the entire insolation range. Additionally, system sensitivity, bandwidth, and damping characteristics of the battery control are shown to be acceptable for a projected hardware implementation. Author

N79-29600*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

THE ALKALINE ZINC ELECTRODE AS A MIXED POTENTIAL SYSTEM

William L. Fielder Jul. 1979 22 p refs

(NASA-TM-79235; E-141) Avail: NTIS HC A02/MF A01 CSCL 10C

Cathodic and anodic processes for the alkaline zinc electrode in 0.01 molar zincate electrolyte (9 molar hydroxide) were investigated. Cyclic voltammograms and current-voltage curves were obtained by supplying pulses through a potentiostat to a zinc rotating disk electrode. The data are interpreted by treating the system as one with a mixed potential; the processes are termed The zincate and corrosion reactions. The relative proportions of the two processes vary with the supplied potential. For the cathodic region, the cathodic corrosion process predominates at higher potentials while both processes occur simultaneously at a lower potential (i.e., 50 mV). For the anodic region, the anodic zincate process predominates at higher potentials while the anodic corrosion process is dominant at lower potential (i.e., 50 mV) if H2 is present. Author

N79-29601*# Wyle Labs., Inc., Huntsville, Ala.

LONG-TERM WEATHERING EFFECTS ON THE THERMAL PERFORMANCE OF THE SOLARGENICS (LIQUID) SOLAR COLLECTOR AT OUTDOOR CONDITIONS

Jul. 1979 13 p refs Prepared for DOE

(Contract NAS8-32036)

(NASA-CR-150523; TR-531-28-Add) Avail: NTIS HC A02/MF A01 CSCL 10A

The test procedures and the results obtained during the evaluation of a single-covered liquid solar collector are presented. The tests were performed under outdoor natural conditions. The collector was under stagnation conditions for a total of approximately ten months. The solar collector is a liquid, single-glazed, flat plate collector, and is about 240 inches long, and 3.8 inches in depth. K.L.

N79-29602*# Wilson and Co., Salina, Kans.

SOLAR HEATING AND HOT WATER SYSTEM INSTALLED AT SOUTHEAST OF SALINE, UNIFIED SCHOOL DISTRICT 306, MENTOR, KANSAS

Jul. 1979 119 p Prepared for NASA and DOE

(Contract EG-77-A-01-4077)

(NASA-CR-161271) Avail: NTIS HC A06/MF A01 CSCL 10A

The solar system, installed in a new building, was designed to provide 52 percent of the estimated annual space heating load and 84 percent of the estimated annual potable hot water requirement. The liquid flat plate collectors are ground-mounted and cover a total area of 5125 square feet. The system will provide supplemental heat for the school's closed-loop water-to-air heat pump system and domestic hot water. The storage medium is water inside steel tanks with a capacity of 11,828 gallons for space heating and 1,600 gallons for domestic hot water. The solar heating facility is described and drawings are presented of the completed system which was declared operational in September 1978, and has functioned successfully since. A.R.H.

N79-29603*# Owens-Illinois, Inc., Toledo, Ohio.

ALTERNATE METHODS OF APPLYING DIFFUSANTS TO SILICON SOLAR CELLS Final Report, Jan. 1977 - Jan. 1978

Thomas W. Brock and Marshall B. Field (Pantek International, Lewistown, Pa.) Aug. 1979 23 p refs

(Contract NAS3-20579)

(NASA-CR-159508) Avail: NTIS HC A02/MF A01 CSCL 10A

Low-melting phosphate and borate glasses were screen printed on silicon wafers and heated to form n and p junctions. Data on surface appearance, sheet resistance and junction depth are presented. Similar data are reported for vapor phase transport from sintered aluminum metaphosphate and boron-containing glass-ceramic solid sources. Simultaneous diffusion of an N(+) layer with screen-printed glass and a p(+) layer with screen-printed Al alloy paste was attempted. No p(+) back surface field formation was achieved. Some good cells were produced but the heating in an endless-belt furnace caused a large scatter in sheet resistance and junction depth for three separate lots of wafers. Author

N79-29604*# Energy Research Corp., Danbury, Conn.

TECHNOLOGY DEVELOPMENT FOR PHOSPHORIC ACID FUEL CELL POWERPLANT, PHASE 2 Quarterly Report

Larry Christner Mar. 1979 50 p refs Prepared for NASA and DOE

(Contract DEN3-67)

(NASA-CR-159572; DOE/NASA/0067-79/1) Avail: NTIS HC A03/MF A01 CSCL 10B

Component development has resulted in routine molding of 12 in. by 17 in. bipolar plates with 80 percent acceptance. A 5 C per hour post-cure heating cycle for these plates was found to give blister free materials. Lowering the resin in a bipolar plate content from 32 percent to 22 percent decreases the resistivity more than 50 percent. Evaluation of the corrosion resistance of Novolak and Resol resins at 185 C in phosphoric acid indicates a slow etch. Aresol modified phenolics, however, decompose rapidly. Estimates of acid loss by the use of analytical expressions known as Margule, van Laar, and Wilson equations were not satisfactory. Experimental evaluation of the P4O10 vapor concentration of 103 wt percent acid at 191 C provided a value of 2 ppm. This value is based on a single experiment. Author

N79-29605# Resource Planning Associates, Inc., Washington, D. C.

EUROPEAN WASTE-TO-ENERGY SYSTEMS: CASE STUDY OF RENNES, FRANCE

Sep. 1978 45 p ref

(Contract EC-77-C-01-2103)

(HCP/M2103-0008) Avail: NTIS HC A03/MF A01

The Rennes waste-to-energy unit is described. The unit, which burns the municipal solid waste of the city and 26 surrounding small communities, is connected to the district heating network. Along with an oil-fired heating plant, the Rennes combustion unit provides space heating and domestic hot water for nearly 5,000 housing units, hospital buildings, university dormitories, and other institutional and commercial buildings. The sale of energy recovered from municipal solid waste more than pays for the operation of the combustion unit. The collection of waste,

the design and operation of the system, and the cost of the system are discussed in detail. R.E.S.

N79-29606*# North Carolina State Univ., Raleigh. Solid State Electronics Lab.
A THEORETICAL ANALYSIS OF THE CURRENT-VOLTAGE CHARACTERISTICS OF SOLAR CELLS Final Report
R. C. Y. Fang and J. R. Hauser Jan. 1979 334 p refs
(Grant NGR-34-002-195)
(NASA-CR-158872) Avail: NTIS HC A15/MF A01 CSCL 10A

The following topics are discussed: (1) dark current-voltage characteristics of solar cells; (2) high efficiency silicon solar cells; (3) short circuit current density as a function of temperature and the radiation intensity; (4) Keldysh-Franz effects and silicon solar cells; (5) thin silicon solar cells; (6) optimum solar cell designs for concentrated sunlight; (7) nonuniform illumination effects of a solar cell; and (8) high-low junction emitter solar cells. G.Y.

N79-29607*# RCA Labs., Princeton, N. J.
AUTOMATED ARAY ASSEMBLY, PHASE 2 Interim Report
R. V. DAiello Jan. 1979 136 p refs Prepared for JPL and DOE
(Contracts NAS7-100; JPL-954868)
(NASA-CR-158874; DOE/JPL-954868-79/1) Avail: NTIS HC A07/MF A01 CSCL 10A

A manufacturing process suitable for the large-scale production of silicon solar array modules at a cost of less than $500/peak kW is described. Factors which control the efficiency of ion implanted silicon solar cells, screen-printed thick film metallization, spray-on antireflection coating process, and panel assembly are discussed. Conclusions regarding technological readiness or cost effectiveness of individual process steps are presented. J.M.S.

N79-29608*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
SOLAR ENGINE Patent Application
Ronald N. Jensen, inventor (to NASA) Filed 22 Jun. 1979 12 p
(NASA-Case-LAR-12148-1; US-Patent-Appl-SN-051275) Avail: NTIS HC A02/MF A01 CSCL 10B

A solar engine is disclosed in which a fluid, which is first heated and then cooled, forces a piston outward as the fluid is heated, and then draws inward as the fluid is cooled. The piston is connected to a shaft and produces work as it moves outward and inward. A displacer plate moves between an absorber plate and a cooling plate to form an air space between the displacer and one or the other of these two plates for heating and cooling the fluid. The displacer plate is for heating and cooling the fluid. The displacer plate is moved from one plate to the other by the displacer push ring as the piston nears the midpoint of its travel on the outward stroke and again on the inward stroke. NASA

N79-29609# Committee on Government Operations (U. S. House).
SOLAR ENERGY
Washington GPO 1979 634 p refs Hearings before a Subcomm. of the Comm. on Government Operations, 95th Congr., 2d Sess., 12 May; 12-14 Jun. 1978
(GPO-36-957) Avail: Comm. on Government Operations

A general overview of the status of solar energy technology in the United States is given with emphasis on the state of California. Solar collectors, photovoltaics as well as biomass conversion and other less direct, but solar based technologies are discussed. Demonstration projects, in industrial as well as residential buildings, are included. Program goals, incentives, projected energy savings, and cost factors are among the factors considered. J.M.S.

N79-29610# Eureka Advance Science Corp., Bloomington, Ill. Advance Science Div.
ADVANCED THERMAL BATTERIES Interim Report, Sep. 1977 - Sep. 1978
David M. Ryan Dec. 1978 105 p
(Contract F33615-77-C-3147; AF Proj. 3145)
(AD-A068889; AFAPL-TR-78-114) Avail: NTIS HC A06/MF A01 CSCL 10/3

The feasibility of building thermal batteries with cells composed of an anode of LiAl alloy, a cathode of a heavy metal chloride and a NaAlCl4 electrolyte has been demonstrated. Engineering research is now being done to further characterize and improve this battery system. A commercial source of NaAlCl4 has been tested and found to be quite satisfactory for the preparation of battery materials. Various lithium alloys (viz., 20 w/o LiAl, 40 w/o LiAl, and LiSi) have been characterized and found to be alternate anode materials. The relative amount and nature of the binder or antiflow agent present in the electrolyte powders has been investigated. GRA

N79-29611# Mallory (P. R.) and Co., Inc., Burlington, Mass. Lab. for Physical Science.
LITHIUM-THIONYL CHLORIDE BATTERY Quarterly Report, 1 Oct. - 31 Dec. 1978
A. N. Dey, W. Bowden, J. Miller, and P. Witalis Apr. 1979 70 p refs
(Contract DAAB07-78-C-0563; DA Proj. 1L1-62705-AH-94)
(AD-A068422; DELET-TR-78-0563-1; QR-1) Avail: NTIS HC A04/MF A01 CSCL 10/3

The Li/socl2 inorganic electrolyte system is the highest energy density system known to date. It consists of a LI anode, a carbon cathode and socl2 which acts both as a solvent and as a cathode active material. The electrolyte salt that has been used most extensively is LiAlCl4, but salts such as li2B10Cl10 and Li2 (OAlC3) 2 have also been used successfully in this system for improving the shelf life characteristics. The main objective of this program is to develop high rate Li/socl2 cells and batteries for various portable applications of the U. S. Army. The cells and batteries must deliver higher energy densities than are presently available and must be safe to handle under U. S. Army field conditions. GRA

N79-29612# Gulton Industries, Inc., Hawthorne, Calif. Engineered Magnetics Div.
DEVELOPMENT PROGRAM FOR 3.0 KW INVERTER: MILITARIZED INVERTER FOR USE WITH FUEL CELL OR BATTERY POWER PLANTS Final Report, Dec. 1976 - Dec. 1978
John E. Rance 15 Jan. 1979 24 p
(Contract DAAK70-77-C-0012)
(AD-A068433) Avail: NTIS HC A02/MF A01 CSCL 10/2

This report describes the design, construction and testing of a static inverter rated at 3.0 kilowatts. Circuit techniques were evaluated to obtain desired results with considerations to cost, reliability, maintainability, weight, size and efficiency. The application of this portable, rugged inverter is to replace mechanical alternating generators used in the field. GRA

N79-29613# Naval Research Lab., Washington, D. C.
RESULTS OF THE SOLAR CELL EXPERIMENTS ABOARD THE NTS-2 SATELLITE AFTER 447 DAYS IN ORBIT Interim Report
D. H. Walker and R. L. Statler 9 Mar. 1979 52 p refs
(AD-A069082; AD-E000295; NRL-MR-3935) Avail: NTIS HC A04/MF A01 CSCL 10/2

Results after 447 days in orbit of the solar cell experiments aboard the NTS-2 satellite are presented. The objective of the solar cell experiment, consisting of 15 separate experiments of five cells each, is to evaluate the performance of state-of-the-art solar cells in the space environment. Telemetered data from the 14 silicon and one gallium arsenide modules indicate a more severe radiation environment in the 63 degree, 20,190 km circular orbit than was predicted. Based on the NTS-2 data, the solar power array containing Spectrolab Helios cells will degrade 27% in maximum power over the three-year mission. Solar cell panel temperatures have reached 104 C providing ideal conditions for annealing of the radiation-induced damage in the gallium arsenide cells. After 15 months of operation these cells have suffered the least power degradation, with a maximum power loss of 14.0%. After 447 days in orbit, the loss in power ranged from 14.0% to 59.5% with the exception of the Solarex 'low-cost space cell' which became open-circuited on the 69th day. The average value of I sub sc measured in space on the first day of exposure agreed with prelaunch solar simulator values to within

1 + or - 0.99%. The agreement between V sub oc in space and solar simulator values was 1.24 + or - 1.08%. Results are summarized of the changes in the photovoltaic parameters of each of the experiments. GRA

N79-29614# Tetra Tech, Inc., Arlington, Va.
DEPARTMENT OF THE NAVY ENERGY FACT BOOK
May 1979 520 p refs
(Contract N00014-78-C-0434)
(AD-A069138; TETRAT-A-6054-403) Avail: NTIS HC A22/MF A01 CSCL 10/2

The Department of the Navy Energy Fact Book presents the U.S., including the DoD and Navy, energy situation; summarizes Navy energy R and D initiatives; provides an in-depth description of the various processes and developments related to hydrocarbon fuels, synthetic fuels, non-hydrocarbon energy sources, and energy conversion, and briefly describes energy R and D legislation and cooperative energy programs. GRA

N79-29615# Coast Guard Research and Development Center, Groton, Conn.
ECONOMIC ANALYSIS OF SOLAR PHOTOVOLTAICS FOR LOW-POWER LIGHTED AIDS TO NAVIGATION Final Report
William R. Allen Jun. 1978 53 p refs
(AD-A068365; CGR/DC-11/78; USCG-D-23-79) Avail: NTIS HC A04/MF A01 CSCL 20/1

A detailed economic analysis with decision-making criteria for converting the present energy storage system used on U.S. Coast Guard low-power lighted aids to navigation to one that relies upon conversion of solar energy by photovoltaics is presented. The analysis demonstrates that converting 12-volt lighted aids to navigation from reliance on primary air-cell batteries to reliance on solar photovoltaics is attractive from an economic point of view. However, questions concerning reliability and life must be answered before the Coast Guard plans conversion to solar photovoltaics. GRA

N79-29616# IIT Research Inst., Chicago, Ill.
HYDROGEN GENERATOR SUBSYSTEM: CATALYST AND EQUIPMENT DEVELOPMENT FOR THERMO-CATALYTIC CRACKER Final Technical Report
R. Henry Nov. 1978 106 p refs
(Contract DAAG53-76-C-0081; DA Proj. 1L2-63701-DG-10)
(AD-A068452; IITRI-C6363-33) Avail: NTIS HC A06/MF A01 CSCL 10/2

Future Army plans call for generation of silent electrical power in field situations. Hydrogen/air fuel cells are considered viable electrical power generators. Currently available logistic fuels are hydrocarbon; requiring a fuel conditioning process to free hydrogen for use by the fuel cell. This report concerns one such process to obtain hydrogen from hydrocarbon fuels. Experimental work is aimed at optimizing a catalyst for catalytic cracking and the development of a breadboard hydrogen generator. Further work is needed in both these areas. GRA

N79-29617# Michigan State Univ., East Lansing.
SMALL LOW-HEAD HYDROELECTRIC POWER
O. Krauss Aug. 1978 495 p refs Presented at Midwest Regional Conf., East Lansing, Mich., 23 May 1978
(Contract ET-78-S-07-1732)
(IDO-10076; Conf-7805120) Avail: NTIS HC A21/MF A01

The rehabilitation of abandoned hydro sites and generation of power at dams which were constructed for nonpower purposes which could add to the supply of electric energy is presented. Such development near the sites could aid local economies. Multipurpose uses were considered. Major economic and/or institutional problems were delineated. DOE

N79-29618# Purdue Research Foundation, Lafayette, Ind.
SUPER HYDRIDES Final Report, 1 May 1976 - 30 Jan. 1979
Herbert C. Brown 30 Apr. 1979 22 p refs
(Grant DAAG29-76-G-0218)
(AD-A069307; ARO-13810.14-C) Avail: NTIS HC A02/MF A01 CSCL 07/3

Lithium triethylborohydride (Super Hydride) is a versatile reagent. It cleanly reduces alkyl tosylates to hydrocarbons, providing a convenient procedure for the deoxygenation of alcohols. Super Hydride reduces tertiary amides into primary alcohols via carbon nitrogen fission during the reduction. A chiral trialkylborohydride, lithium B-isopinocampheyl-9-BBN hydride was shown to be an asymmetric reducing agent for the conversion of ketones into optically active alcohols. During this study, methods were developed for the preparation of lithium borohydride, calcium borohydride, and borane-methyl sulfide from the readily available and economical reagent, sodium borohydride. The chemistry of dialkylborohydrides has been studied. The reactions of various alkali metal hydrides with representative trialkylboranes have been explored in an attempt to employ the resulting reagents for organic synthesis. GRA

N79-29619# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
DIGITAL SIMULATION AND PARAMETER ESTIMATION TECHNIQUES FOR THE E-LINE PULSE-FORMING NETWORK M.S. Thesis
Larry W. Vannoy Mar. 1979 115 p refs
(AD-A069199; AFIT/GE/EE/79-2) Avail: NTIS HC A06/MF A01 CSCL 09/3

A line-type, voltage-fed, pulse-forming network, called the E-Line, is studied. The energy to be delivered to the load is stored in a source capacitor at the front of the network. Storing all the energy in the source capacitor leads to a more reliable and lightweight system than is achievable by a conventional network where all the capacitors store energy. The network is to deliver 100-200 rectangular pulses per second to the load where each pulse is 20-30 microseconds in duration and has a pulse height of 30,000 volts. A computer program is developed which models the discharge of the network and is used to analyze the output pulse shape for different inductor and capacitor values within the network. Another computer program is developed which estimates the inductor and capacitor values needed for the network to give a close approximation to the desired rectangular pulse. The simulation program models the discharge of the actual network very well. The estimation program as applied in this thesis does a poor job of predicting the inductor and capacitor values needed. The desired rectangular pulse is not achieved. Recommendations are included which may improve the simulation program, estimation program, and the actual pulse shape. GRA

N79-29620# Department of Energy, Washington, D. C. Div. of Solar Technology.
GUIDE TO SOLAR ENERGY PROGRAMS
Jun. 1978 75 p refs
(DOE/ET-0036/1) Avail: NTIS HC A04/MF A01

The following are included: Department of Energy mission and objectives, overview of the Department of Energy's solar energy programs, program activities and structure, solar energy programs now functioning under the Division of Conversion and Solar Applications, methods of procurement and guides for proposal preparation, and sources of solar energy information and activities supporting the solar energy program. Author (DOE)

N79-29621# Battelle Pacific Northwest Labs., Richland, Wash.
ROLE OF GOVERNMENT IN SOLAR ENERGY DEVELOPMENT: A VIEW FROM THE NORTHWEST
Jill A. Goodnight and Sarah T. King Aug. 1978 181 p refs
(Contract EY-76-C-06-1830)
(PNL-2784) Avail: NTIS HC A09/MF A01

Several economic feasibility studies of solar heating in the Northwest are described. The case for federal assistance to the solar industry and the consumer is developed. The solar related activities undertaken by the Northwest states of Oregon, Idaho, Washington, and Montana are detailed. Finally, roles are addressed which municipal government may play either to encourage or to deter the widespread use of solar heating systems. DOE

N79-29622# Brown Univ., Providence, R. I. Div. of Engineering.
GEOTHERMAL POWER PLANTS OF NEW ZEALAND, PHILIPPINES, AND INDONESIA: A TECHNICAL SURVEY OF EXISTING AND PLANNED INSTALLATIONS
Ronald DiPippo Jun. 1978 123 p refs
(Contract EY-76-S-02-4051)
(COO-4051-23; CATMET/17) Avail: NTIS HC A06/MF A01

Geothermal power plants in the south Pacific area were surveyed including New Zealand, the Philippines and Indonesia. The geologic characteristics of the fields are described along with wellflow particulars, energy conversion systems, environmental impacts, economic factors and operating experiences, where available. The geothermal resource utilization efficiency is computed or estimated for the power plants covered. Furthermore, some discussion is devoted to the other sites which may prove exploitable for the production of electricity. DOE

N79-29623# Market Facts, Inc., Washington, D. C.
LARGE WIND ENERGY FOCUS GROUP RESULTS
Aug. 1978 35 p
(Contract EY-78-C-01-6458)
(DOE/TIC-10038) Avail: NTIS HC A03/MF A01

A report is presented of the focus group research on large wind energy systems prepared for the Department of Energy as part of the commercialization program. The potential for commercialization of wind energy is evaluated to determine the barriers to development of this resource, and to judge what actions are required by the Federal Government to promote commercialization. The issues of commercialization as examined by a focus group consisting of key individuals from various organizations involved in large wind energy systems development are discussed. DOE

N79-29624# Kernforschungsanlage, Juelich (West Germany). Programmgruppe Systemforschung und Technologische Entwicklung.
POSSIBILITIES AND LIMITATIONS OF SOLAR ENERGY UTILIZATION WITH THE USE OF LOW-TEMPERATURE COLLECTORS IN THE GERMAN FEDERAL REPUBLIC: PRINCIPLES, ENGINEERING SYSTEMS, ECONOMY
M. Melib Dec. 1978 247 p refs In GERMAN; ENGLISH abstract
(Juel-Spez-25; ISSN-0313-7639) Avail: NTIS (US Sales Only) HC A11/MF A01; DOE Depository Libraries

Technical performance and economy of low-temperature solar collector systems are investigated with regard to their possible application for the LT-heat supply in the FRG. The systems consist of a flat plate collector system, including storage, and a conventional back-up system and may be assisted by an electrically driven heat pump. The analysis is carried out by computer simulation based on a mathematical model of the different kinds of LT-system-components. The separate modelling of collector, heat exchanger, storage facility, heat pump, etc. makes the various composition of components possible. Four types of LT-collector systems are investigated: domestic hot water supply system, house heating system, combined house heating and hot water supply system, and solar assisted heat pumps for heating and hot water supply. Simulations are based upon hourly data of total insolation and ambient temperature measured at Hamburg and Munich. DOE

N79-29625# Lincoln Lab., Mass. Inst. of Tech., Lexington.
PHASE-ONE EXPERIMENT TEST PLAN SOLAR PHOTOVOLTAIC/THERMAL RESIDENTIAL EXPERIMENT
Edward C. Kern, Jr. 15 Mar. 1979 16 p refs
(Contract EG-77-S-02-4577)
(COO-4577-6) Avail: NTIS HC A02/MF A01

Objectives, rationale, and method of a one-year experiment using a residential photovoltaic/thermal power system are presented. Data archived and processed to investigate: (1) series heat pump system performance; and (2) electric utility impacts. A parallel heat pump system is investigated in a subsequent experiment. DOE

N79-29626# Argonne National Lab., Ill. Energy and Environmental Systems.
OTEC POWER SYSTEMS
Jeffrey S. Horowitz 1978 29 p refs Presented at ASME Energy Technol. Conf. and Exhibition, Houston, Tex., 5-9 Nov. 1978
(Contract W-31-109-eng-38)
(CONF-781112-12) Avail: NTIS HC A03/MF A01

At present a major part of the OTEC Program is the power system development (PSD). Currently the PSD activity is divided into three parts; PSD 1, PSD 2, and support activities. PSD 1 is the design of a 50 MWe power system using shell and tube heat exchangers in which three contractors are involved. PSD 2 is a parallel effort which pursues the same goals with the use of nonshell-and-tube heat exchangers. The support activities center about the development of heat exchangers. Each of these areas are described, and the relationships between PSD and the remainder of the OTEC Program are discussed. DOE

N79-29627# Lincoln Lab., Mass. Inst. of Tech., Lexington.
PHOTOVOLTAIC POWER SYSTEM FIELD TESTS
M. D. Pope and R. W. Matlin Jun. 1978 9 p refs Presented at IEEE Photovoltaic Specialists Conf., Washington, D. C., 5 Jun. 1978
(Contract EY-76-C-02-4094)
(COO-4094-15; Conf-780619-20) Avail: NTIS HC A02/MF A01

The systems discussed are photovoltaic (PV) agricultural testing which includes the existing 25 kW peak system as well as on-going development of very small microirrigation systems consuming less than 1 kW peak; a 1.6 kW system; the Lincoln PV system test facility at Lexington, Massachusetts; four real-time endurance test sites located in the northeast; the Natural Bridges 100 kW PV power system; and a 20 kW PV power system for one AM radio station. The latter two systems are presently being designed. Experience gained from these projects is discussed in the contexts of storage, system reliability and safety, efficiency implications, and costs of PV structural and foundation elements. DOE

N79-29628# California Univ., Berkeley. Lawrence Berkeley Lab.
ANALYSIS OF THE CALIFORNIA SOLAR RESOURCE. VOLUME 1: EXECUTIVE SUMMARY
P. Berdahl, D. Grether, M. Martin, and M. Wahlig Nov. 1978 16 p refs
(Contract W-7405-eng-48)
(LBL-7860-Vol-1) Avail: NTIS HC A02/MF A01

User needs for solar radiation data is summarized along with California sources of solar radiation data. The components of a solar data program that will satisfy solar data needs are given. J.M.S.

N79-29629# Department of Energy, Washington, D. C. Office of Solar, Geothermal, Electric and Storage Systems.
INSOLATION RESOURCE ASSESSMENT PROGRAM PLAN Fiscal Years, 1979 - 1981
Jan. 1979 49 p refs
(DOE/ET-0082) Avail: NTIS HC A03/MF A01

The collection, processing, and archiving of geophysical data for solar energy application is planned. The principal solar parameters to be measured are global, direct, diffuse, and total radiation on an inclined surface. The measurement of the spectral distribution of solar radiation is also important to the development of several technologies. Completed, current, and planned projects to improved solar data collection methods and procedures and to refine solar radiation forecasting capabilities are presented. DOE

N79-29630# Oak Ridge National Lab., Tenn.
ELECTRICITY IN LIEU OF NATURAL GAS AND OIL FOR INDUSTRIAL THERMAL ENERGY: A PRELIMINARY SURVEY
J. R. Tallackson Feb. 1979 126 p refs
(Contract W-7405-eng-26)
(ORNL/TM-5937) Avail: NTIS HC A07/MF A01

The capability of the process industries to substitute utility-generated electricity for natural gas and oil is assessed. It is concluded that the existing technology will permit substitution of electricity for approximately 75% of the natural gas and petroleum now being consumed by industrial processors. Process steam generation, representing 40% of its energy usage, offers the best near-term potential for conversion to electricity. Electric boilers and energy costs for steam are briefly discussed. Electrically driven heat pumps are considered as a possible method to save additional low-grade energy. Electrical reheating at high temperatures in the primary metals sector will be in effective way to conserve gas and oil. A wholesale shift by industry to electricity to replace gas and oil will produce impacts on the

public utilities. The principal bar to large-scale electrical substitution is economics, not technology. DOE

N79-29631# Westinghouse Electric Corp., East Pittsburgh, Pa. Advanced Systems Technology Div.
METHODOLOGY FOR SOLAR-THERMAL POWER PLANT EVALUATION
J. T. Day Aug. 1978 129 p refs Sponsored by Elec. Power Res. Inst.
(EPRI Proj. 648-1)
(EPRI-ER-869) Avail: NTIS HC A07/MF A01

The development of an evaluation methodology, including process for evaluating solar thermal plant impact on utility reliability and margin requirements and economics, plus the impact of solar plant penetration is presented. In addition to a general methodological framework, specific methods covered include a specific economic calculation methodology, a process for modeling the interdependent operation of a solar plant and the balance of the utility system, a procedure for reserve margin analysis, and a method for solar plant penetration analysis. DOE

N79-29632# Pennsylvania Univ., Philadelphia. Dept. of Mechanical Engineering and Applied Mechanics.
TEMPERATURE MEASUREMENT AND SENSOR SELECTION FOR SOLAR HEATING AND COOLING SYSTEMS
Noam Lior 1978 21 p refs Presented at Conf. on Performance Monitoring Tech. for Evaluation of Solar Heating and Cooling Systems, Washington, D. C., 3-4 Apr. 1978
(Contract EG-77-S-02-4142)
(COO-4142-3; Conf-780432-5) Avail: NTIS HC A02/MF A01

The different methods for temperature and temperature difference measurement are described as to their applicability to solar heating and cooling systems. The major commercial temperature sensors are surveyed, and their technical and economic aspects are discussed. Installation and calibration techniques are recommended. The temperature measuring system implemented in the University of Pennsylvania Solar Row House as a consequence of the above considerations is described. DOE

N79-29633# Dunham Associates, Inc., Bismarck, N. Dak.
BISMARCK, NORTH DAKOTA, OFFICE COMMERCIAL SOLAR DEMONSTRATION DESIGN AND CONSTRUCTION REPORT
5 Jan. 1979 25 p
(Contract EG-77-C-02-4228)
(COO-4228-1) Avail: NTIS HC A02/MF A01

The demonstration consisted of adding 5000 square feet of flat, plate collector to an existing four story, 75,000 square feet office building. The existing mechanical system is an electric water to water heat pump system with 60,000 gallons of thermal storage. The retrofit design converted one 20,000 gallon tank for use as solar storage and added the 5000 square feet of double glazed, selective surface, flat plate collector. The solar collector is mounted as a ground mounted array which is stepped down a hillside. The array is expected to provide 1944 million BTU of useable energy annually. That energy is equivalent to 34% of the building heating energy. DOE

N79-29634# Los Alamos Scientific Lab., N. Mex. Systems, Analysis, and Assessment Div.
TROMBE WALLS AND DIRECT GAIN: PATTERNS OF NATIONWIDE APPLICABILITY
Scott A. Noll, J. Fred Roach, and Shaul Ben-David (New Mex. Univ., Albuquerque) 1979 9 p refs Presented at 3d Natl. Passive Solar Conf., San Jose, 11-13 Jan. 1979
(Contract W-7405-eng-36)
(LA-UR-79-239; Conf-790106-5) Avail: NTIS HC A02/MF A01

The economic performance of Trombe wall and direct gain passive solar heating designs are elevated on a nationwide basis using the LASL/UNM solar economic performance code. Both designs are integrated into a ranch style tract home concept thereby facilitating regional comparisons. Solar add-on costs are established for each design with regional differences in material and labor prices accounted for at each site. System sizes are optimized against the natural gas and electric resistance heating alternatives, the current price and future escalation of which is established for each locale. Results for each passive solar design are summarized on a state-by-state basis followed by a discussion of their comparative economic performance. DOE

N79-29635# Solar Systems of Virginia, Inc., Hampton.
COST EFFECTIVE SOLAR HOT WATER SYSTEM FOR ECONO-TRAVEL MOTOR HOTEL LOCATED AT WOODBRIDGE, VIRGINIA Final Report
Nov. 1978 18 p
(Grant EM-78-G-02-4661)
(COO-4661-1) Avail: NTIS HC A02/MF A01

The description of the system presented along with the final breakdown, performance data and payback time are given. The payback time for the installed system is approximately four years instead of the 7.2 years estimated for the proposal. The additional savings is due to the reduction in the peak demand charge since the electric hot water heaters are not required to operate at the same time each morning as the dryers used for the laundry. As called for in the proposal to DOE, the success of the system is determined by the reduction in the utility cost and reduced use of our fossil fuels. The lower hotel's monthly electricity bills indicate that this goal was accomplished. DOE

N79-29636# Argonne National Lab., Ill. Solar Energy Group.
DESIGN AND INSTALLATION MANUAL FOR THERMAL ENERGY STORAGE
Roger L. Cole, ed., Kenneth J. Nield, ed., Raymond R. Rhode, ed., and Ronald M. Wolosewicz, ed. Feb. 1979 283 p refs
(Contract W-31-109-eng-38)
(ANL-79-15) Avail: NTIS HC A13/MF A01

Information on the design and installation of thermal energy storage in solar heating systems is provided. The manual presented includes sizing storage, choosing a location for the storage device, and insulation requirements. Both air-based and liquid-based systems are covered with topics on designing rock beds, tank types, pump and fan selection, installation, costs, and operation and maintenance. Topics relevant to heating domestic water include safety, single- and dual-tank systems, domestic water heating with air- and liquid-based space heating system, and stand-alone domestic hot water systems. DOE

N79-29637# B and A Engineers Ltd., Chicago, Ill.
ASSESSMENT OF THE TECHNOECONOMIC FEASIBILITY OR SEASONAL THERMAL ENERGY STORAGE SYSTEMS (STES)
Dec. 1978 81 p refs
(Contract W-31-109-eng-38)
(ANL/EES-TM-35) Avail: NTIS HC A05/MF A01

The feasibility of the use of seasonal thermal energy storage systems employing large volumes of water is examined on the bases of technology and economics. Three building types are considered: single-family houses, low-rise multi-family apartment buildings, and small commercial buildings. Construction costs are based on prevailing conditions in the suburban Chicago area marketplace. Various types of vessels above and below ground are considered along with possible vessel materials. DOE

N79-29638# Brown Univ., Providence, R. I. Engineering Div.
GEOTHERMAL POWER PLANTS OF MEXICO AND CENTRAL AMERICA: A TECHNICAL SURVEY OF EXISTING AND PLANNED INSTALLATIONS
Ronald DiPippo Jul. 1978 103 p refs
(Contract EY-76-S-02-4051)
(COO-4051-26) Avail: NTIS HC A06/MF A01

The geoethermal power plants of Mexico and Central America were studied. The geothermal plants are located in areas of recent and active volcanism; the resources are of the liquid-dominated type. Details are given about the plants located at Cerro Prieto in Mexico and at Ahuachapan in El Salvador. In both cases, attention is paid to the geologic nature of the fields, the well programs, geofluid characteristics, energy conversion systems, materials of construction, effluent handling systems, economic factors and plant operating experience. Exploration and development activities are described for other promising geothermal areas in Mexico and El Salvador, along with those in the countries of Costa Rica, Nicaragua, Guatemala, Honduras, and Panama. DOE

N79-29639# Brown Univ., Providence, R. I. Engineering Div.
INTRODUCTION TO ELECTRIC ENERGY CONVERSION SYSTEMS FOR GEOTHERMAL ENERGY RESOURCES
Ronald DiPippo Jun. 1978 21 p refs
(Contract EY-76-S-02-4051)
(COO-4051-28) Avail: NTIS HC A02/MF A01

The types of geothermal energy conversion systems in use are classified as follows: direct, dry steam; separated steam; single-flash steam; double-flash steam; multi-flash steam; brine/Freon binary cycle; and brine/isobutane binary cycle. The thermodynamics of each of these is discussed with reference to simplified flow diagrams. Typical existing power plants are identified for each type of system. DOE

N79-29640# Applied Physics Lab., Johns Hopkins Univ., Laurel, Md.
POTENTIAL APPLICATION OF MADISON FORMATION WATERS FOR COMMUNITY HEATING IN SOUTH DAKOTA
R. A. Freeman and R. F. Meier Sep. 1978 44 p refs
(Contract EX-76-A-36-1008)
(APL/JHU/QM-78-042R) Avail: NTIS HC A03/MF A01

The general design of such a community system is discussed along with its cost, means of financing, and life expectancy. Legal questions and state statutes that are pertinent are cited and the life expectancy of the entire Madison resource and equipment to exploit the resource are considered. DOE

N79-29641# Battelle Pacific Northwest Labs., Richland, Wash.
EFFECTS OF WATER ON COMPRESSED AIR ENERGY STORAGE IN POROUS ROCK RESERVOIRS
L. E. Wiles Mar. 1979 102 p refs
(Contract EY-76-C-06-1830)
(PNL-2869) Avail: NTIS HC A06/MF A01

The magnitudes of the potential effects of residual water on the operation of an aquifer compressed air energy storage facility were quantified by numerically solving the conservation equations describing the transport of mass and energy in the reservoir. The results of the analysis provided reservoir behavior in terms of pressure, flow rate, temperature, humidity, and residual water conditions as functions of time. The change in response of the reservoir to variation of residual water content, injection air humidity and injection air temperature demonstrates the impact of these parameters. DOE

N79-29642# Pacific Gas and Electric Co., San Francisco, Calif.
IMPLICATIONS OF THE FUSION POWER SOURCE TO THE ELECTRIC UTILITY INDUSTRY
Nov. 1978 144 p refs Presented at EPRI Executive Seminar on Fusion, San Francisco, Calif., 11 Oct. 1977
(Contract ES-77-G-05-5576)
(EPRI-ER-943-54; Conf-771071-Summ) Avail: NTIS HC A07/MF A01

The viewpoints and plans of the utility industry and the fusion community with respect to thermonuclear power plants are examined. Basic background material concerning the fusion process is emphasized including the current status and future plans of the fusion research and development effort. DOE

N79-29643# Ohio State Univ., Columbus.
WORKSHOP ON ENERGY SOURCES AND ELECTRIC POWER GENERATION FOR HIGH SCHOOL STUDENTS Final Report
Donald D. Glower and Herbert L. Coon Sep. 1978 345 p refs Workshop held at Columbus, Ohio, 11-30 Jun. 1978
(Contract EY-76-C-02-2449)
(TID-28975) Avail: NTIS HC A15/MF A01

Workshop participants studied various aspects of the national energy problem and prepared instructional materials for use in their classrooms. Attention was given to short and long term resources available; to conversion systems; to economic, social and philosophical problems associated with energy production and use; and the importance of conservation. The conversion steps involved in transforming uranium ore into electric power were examined through lectures, audio visual aids, and extensive discussions. DOE

N79-29644# Midland-Ross Corp., Toledo, Ohio. Technical Center - Capital Goods.
RECUPERATIVE SYSTEM FOR HIGH AND ULTRA-HIGH TEMPERATURE FLUE GASES Quarterly Report, Jan. - Mar. 1978
John G. Reitz 10 Apr. 1978 27 p refs
(Contract EC-77-C-07-1672)
(IDO-1672-1) Avail: NTIS HC A03/MF A01

Progress is reported in the development of a tile-metallic recuperative system for industrial application with flue gases in the 1200 to 1900 F temperature range. The planning of program, a literature survey and heat transfer analyses are presented.DOE

N79-29645# Market Facts, Inc., Washington, D. C.
LOW HEAD HYDROPOWER: FOCUS GROUP RESULTS
Aug. 1978 32 p refs
(Contract EV-78-C-01-6458)
(DOE/TIC-10017) Avail: NTIS HC A03/MF A01

The barriers and opportunities associated with the successful commercialization of low head hydropower and the appropriate Federal actions for promoting and facilitating commercialization of this technology were evaluated. The primary questions put before the discussion group participants were: is commercialization of low head hydropower feasible; what is the nature and extent of the market for this technology; what barriers and opportunities are critical to the commercialization of low head hydropower; and what actions, if any, should be taken by the Federal government to bring about successful commercialization of this technology. The opinions, attitudes, and knowledge of the participants on these issues are summarized. DOE

N79-29646# Larson and Associates Ltd., La Jolla, Calif.
STUDY OF THE ENERGY UTILIZATION IN OPERATING OSMOSIS SYSTEMS
Jan. 1979 257 p
(Contract W-7405-eng-26)
(ORNL/TM-6735) Avail: NTIS HC A12/MF A01

The performance of six of the seven largest operating reverse osmosis systems used in the U.S. for desalting water was analyzed to determine the desalting capabilities, operating costs, energy efficiency and methods for improving this energy efficiency. Data on the units, which are located in California, Florida and Texas and which range in size from 1 to 5 MGD capacity, showed that the reverse osmosis systems can remove 90 to 95% of dissolved solids from a variety of feed streams. The energy efficiency of reverse osmosis as currently operated is superior to other forms of commercially available unit processes to achieve 90 to 95% salt reduction. However, the energy efficiency of reverse osmosis could be improved by 30% or more by improving the pumping systems, using higher performance membranes, using waste heat and energy recovery devices and by optimizing the ratio of permeate produced to concentrate discarded. DOE

N79-29647# International Research and Technology Corp., McLean, Va.
TEN SCENARIOS OF TRANSPORTATION ENERGY CONSERVATION USING TECNET Final Report
Ralph M. Doggett, R. Meyer, and M. Heller Mar. 1979 114 p refs
(Contract EX-76-C-01-2101)
(HCP/M2101-1) Avail: NTIS HC A06/MF A01

The TECNET system was developed to provide DOE with the capability to measure the total energy consequences of alternative transportation strategies out to the year 2025. Ten scenarios were tested to obtain a wide array of policy alternatives, beginning with a Base Case scenario (business as usual). The other scenarios include a conservation scenario, scenarios with high penetration rates for alternative engine automobiles, a gas rationing scenario, and a series of sensitivity analyses in which various parameters were altered to test their effects.
Author (DOE)

N79-29648# International Research and Technology Corp., McLean, Va.
FURTHER DEVELOPMENT AND USE OF THE TRANSPORTATION ENERGY CONSERVATION NETWORK (TECNET)
Ralph M. Doggett, A. Shapanka, R. Meyer, and R. Strieter Mar. 1979 184 p refs

(Contract EX-76-C-01-2101)
(HCP/M2101-2) Avail: NTIS HC A09/MF A01

The TECNET model underwent a variety of changes and was used to assess the implications of many different patterns of future transportation demand. Its primary purpose is to estimate the total energy requirements of the transportation sector, under alternative assumptions of transportation trends, out to the year 2025. The model is unique in that it estimates both direct and indirect energy requirements of the transportation sector, within a comprehensive framework that includes a large input-output model for assessing economic impacts, the methodologies for estimating pollution emission from both mobile and stationary sources. Author (DOE)

N79-29649# Midland-Ross Corp., Toledo, Ohio.
RECUPERATIVE SYSTEM FOR HIGH AND ULTRA-HIGH TEMPERATURE FLUE GASES Quarterly Report, Apr. - Jun. 1978
J. G. Reitz 17 Jul. 1978 89 p refs
(Contract EC-77-C-07-1672)
(IDO-1672-2) Avail: NTIS HC A05/MF A01

Progress is reported in the development of a tile-metallic recuperative system for industrial application with flue gases in the 1200 to 1900 F temperature range. The selection of a steel soaking pit demonstration site is investigated, and design studies are included. DOE

N79-29650# Gordian Associates, Inc., Washington, D. C.
ENERGY SUPPLY AND DEMAND BALANCES AND FINANCING REQUIREMENTS IN NON-OPEC DEVELOPING NATIONS Final Report
Feb. 1979 178 p refs
(Contract EH-77-C-01-6407)
(HCP/H6407) Avail: NTIS HC A09/MF A01

The question of possible LDC (less developed countries) responses to energy shortages in three respects is addressed. First, energy conservation and fuel-switching alternatives are examined for industry, transporation, the urban residential sector, and the rural and agricultural sector. Second, small-scale technologies for renewable energy resources are discussed in terms of their potential applications for LDCs. Finally, each LDC country group's range of likely responses to energy shortages is examined in terms of both historical patterns and resource constraints. DOE

N79-29651# General Electric Co., Philadelphia, Pa. Valley Forge Space Center.
REGIONAL CONCEPTUAL DESIGN AND ANALYSIS STUDIES FOR RESIDENTIAL PHOTOVOLTAIC SYSTEMS. VOLUME 1: EXECUTIVE SUMMARY Final Report
Jan. 1979 54 p refs
(Contract EY-76-C-04-0789)
(SAND-78-7039) Avail: NTIS HC A04/MF A01

A wide range of roof-mounted array systems was studied including PV-only systems and combined and separate PV/thermal collection systems which provide heat for space conditioning and domestic hot water. The attractiveness of the system options were assessed in terms of performance and economic competitiveness based on hourly weather data for twelve designated regions of the US representing a broad spectrum of climatic characteristics. The study determined that if PV economic goals are achieved, PV-only solar energy systems for residential use should be emphasized because of their potential economic viability in all regions. On the basis of the costs and benefits used in the analysis, residential systems without batteries are preferred over systems with batteries assuming utility feedback acceptance at some differential buy-back rate such as 40 to 50% of the sell rate. Side-by-side PV/thermal systems become more viable across the nation with a PV system cost to thermal system cost ratio of 1. DOE

N79-29652# California Univ., Berkeley. Lawrence Berkeley Lab.
PROCESS DEVELOPMENT STUDIES ON THE BIOCONVERSION OF CELLULOSE AND PRODUCTION OF ETHANOL
Charles R. Wilke and H. W. Blanch Dec. 1978 55 p refs
(Contract W-7405-eng-48)
(LBL-8658) Avail: NTIS HC A04/MF A01

Progress is reported in the following areas: raw materials and process evaluation, enzyme fermentation studies, ethanol fermentation studies, hydrolysis reactor development, and utilization of hemicellulose sugars. Author (DOE)

N79-29653# Florestal Acesita, Belo Horizonte (Brazil).
SHORT NOTICE ON A GRAND FOREST: TROPICAL LAND CONVERTING SUNLIGHT TO ENERGY
[1978] 20 p
(NP-23278) Avail: NTIS (US Sales Only) HC A02/MF A01; DOE Depository Libraries

The factors that make reforestation of a large area in Brazil feasible are presented. The trees planted are eucalyptus destined for the production of charcoal for steel making in the area. DOE

N79-29654# Argonne National Lab., Ill.
ASSESSMENT AND CONTROL OF OTEC PHYSICAL ENVIRONMENTAL IMPACTS
John D. Ditmars Nov. 1978 12 p refs Presented at Environmental Control Symp., Washington, D. C., 28 Nov. 1978
(Contract W-31-109-eng-38)
(CONF-781109-17) Avail: NTIS HC A02/MF A01

Physical model studies at laboratory scales provided data on the potential for resource degradation as a function of plant design and receiving water characteristics as well as the pathways and mixing of plant trajectories. Continuing physical model studies explore near-plant effluent behavior further for variations in upper ocean stratification and currents. Predictions of intermediate-field spreading and mixing are necessary to estimate impacts in the far wake of a plant and bear on spacing between plants. The results of near-plant and intermediate-field effluent behavior provide the input and boundary conditions for models that simulate the large-scale transport of OTEC perturbations. DOE

N79-29655# Wisconsin Univ. - Madison. Solar Energy Lab.
SIMULATION AND DESIGN OF SOLAR THERMAL PROCESSES
Dec. 1978 11 p
(Contract EY-76-S-02-2588)
(COO-2588-2) Avail: NTIS HC A02/MF A01

Process component model formulations were developed, including: transient LiBr-H2O absorption cooler; CPC and other 'advanced' collectors; and windows, storage wall and shading devices for passive solar heating. Systems studies included: parallel and series solar/heat pump combinations; phase change storage in solar heating; absorption cooling with and without cooler transients. The general solar process simulation program, TRNSYS, was further developed, documented, distributed and supported. Design procedure studies led to development of a method for calculating the phi, the average solar radiation availability, and the development of the phi, f-chart method for design of closed-loop solar heating systems which can have load temperatures other than 20 C and have approximately constant COP of any energy converters between storage and load. DOE

N79-29656# Pennsylvania Univ., Philadelphia. Dept. of Mechanical Engineering and Applied Mechanics.
STANDARDS APPLICABLE TO PERFORMANCE MEASUREMENT OF SOLAR HEATING AND COOLING SYSTEMS
Noam Lior 1978 8 p
(Contract EG-77-S-02-4142)
(COO-4142-2; Conf-780432-4) Avail: NTIS HC A02/MF A01

The advantage of the utilization of existing standards in the performance monitoring of solar heating and cooling systems is discussed. Existing applicable measurement standards and practices are listed. DOE

N79-29657# Brookhaven National Lab., Upton, N. Y. Policy Analysis Div.
SYSTEMS APPROACH TO ENERGY PLANNING
Philip F. Palmedo and Robert Nathans 18 Nov. 1978 21 p refs Presented at Caribbean Consultation on Energy and Agr., Santo Domingo, 1 Dec. 1978
(Contract EY-76-C-02-0016)
(BNL-25523; Conf-781226-1) Avail: NTIS HC A02/MF A01

The criteria of successful energy planning and ways to go

about such planning are outlined. Economic, social, and political factors are discussed along with a wide range of geographical scales, from the household and village to the world scene. A reduced reliance on oil imports is emphasized. DOE

N79-29658# Argonne National Lab., Ill. Energy and Environment Systems Div.
PROCEEDINGS OF THE 2ND WORKSHOP ON ENERGY-CONSERVING SITE DESIGN CASE STUDIES
Robert Hrabak Jan. 1979 111 p refs Proc. held on 14-15 Sep. 1978
(Contract W-31-109-eng-38)
(ANL/ICES-TM-22) Avail: NTIS HC A06/MF A01

Various options for increasing energy conservation through building design are identified and evaluated. Design case studies discussed include: Burke Center in Fairfax Co., Virginia; Radisson in central New York; Greenbrier in Virginia near Norfolk; Shenandoah in Georgia near Atlanta; and the Woodlands in Texas near Houston. Technological progress for each development is summarized. An energy conservation system that collects heat in summer for winter heating and preserves the chill in winter for summer cooling is described. DOE

N79-29659# Argonne National Lab., Ill. Energy and Environmental Systems Div.
METHOD FOR THE PRELIMINARY FEASIBILITY ANALYSIS OF COMMUNITY ENERGY SYSTEMS
Chinmei Lee, Wayne P. Pferdehirt, and Allen S. Kennedy 1979 9 p refs Presented at 3d Natl. Conf. on Technol. for Energy Conversion, Tucson, Ariz., 23-25 Jan. 1979
(Contract W-31-109-eng-38)
(CONF-790107-5) Avail: NTIS HC A02/MF A01

This analysis is provided as a tool to indicate whether, on the basis of potential economic benefits, the application of a community energy system to a specific site should receive additional investigation. Major elements of the analysis include, characterization of community energy demands, engineering design of the system, cost estimation, and economic analysis. DOE

N79-29660# Philips Labs., Briarcliff Manor, New York.
SYSTEM ANALYSIS, DESIGN AND PROOF-OF-CONCEPT EXPERIMENT OF A TOTAL ENERGY SYSTEM, PHASE 2 Final Report, 16 Sep. 1977 - 15 May 1978
B. Ziph Jul. 1978 53 p refs
(Contract EY-76-C-02-2947)
(COO-2947-5) Avail: NTIS HC A04/MF A01

Alternative candidate Stirling engine condigurations for a 1000 kw prime mover were evaluated to determine the configuration showing the most desirable combination of pertinent characteristics. Both single-cylinder and multi-cylinder, and single-acting and double-acting condigurations were considered. Having expressed all characteristics in terms of cost-ownership, the multi-cylinder (8), single-acting configuration was optimum. DOE

N79-29661# Argonne National Lab., Ill. Transportation Energy Systems.
TRANSPORTATION ENERGY CONSERVATION: AN ENVIRONMENTAL OVERVIEW
Martin J. Bernard, III Nov. 1978 24 p refs Presented at DOE Environ. Control Symp., Washington, D. C., 28-30 Nov. 1978
(Contract W-31-109-eng-38)
(CONF-781109-16) Avail: NTIS HC A02/MF A01

The DOE environmental evaluation process, designed to implement NEPA policies and guidance, is effective in addressing environmental concerns early in the development of a technology, strategy, or policy, and in projecting the research and assessment requirements necessary to resolve those concerns. The real success of DOE's method for NEPA implementation will not be known until environmentally and technologically sound transportation energy systems are availabe as a result of the RD and D efforts, or useful policies are implemented. Assessment efforts completed to date focused on electric vehicles since they are about to be demonstrated and have uncovered some possible impacts requiring further study to understand them and to mitigate them. The process is systematic, comprehensively searches all environmental areas for concerns relating to Transportation Energy Conservation program elements, and rigorously assesses the impacts of those concerns. DOE

N79-29662# Logistics Management Inst., Washington, D. C.
INTERNATIONAL ENERGY EVALUATION SYSTEM. VOLUME 1: EXECUTIVE SUMMARY
M. L. Shaw and M. J. Hutzler Mar. 1977 43 p ref
(Contract EC-77-C-01-8602)
(HCP/I8602-01/1) Avail: NTIS HC A03/MF A01

The following topics are discussed: the energy forecasting problem in general; the international energy evaluation system (IEES) forecasting method and how it is distinguished from other international energy forecasting systems; the major components of IEES; and the principal applications of IEES. IEES provides alternatives forecasts of energy prices, supplies, demands, and conversion activities. DOE

N79-29663# United Engineers and Constructors, Inc., Philadelphia, Pa.
TOTAL GENERATING COSTS: COAL AND NUCLEAR PLANTS
Feb. 1979 227 p
(Contract EY-76-C-02-2477)
(NUREG-0248; COO-2477-12) Avail: NTIS HC A11/MF A01

Single and multi-unit coal- and nuclear-fueled electric-generating solutions are described. The total generating cost estimates were developed for commercial operation dates of 1985 and 1990; for 5 and 8% escalation rates, for 10 and 12% discount rates; and, for capacity factors of 50, 60, 70, and 80%. The methodology for obtaining annualized capital costs, levelized coal and nuclear fuel costs, levelized operation and maintenance costs, and the resulting total generating costs for each type of station are reported. The costs are applicable to a hypothetical Middletown site in the Northeastern United States. Plant descriptions with general design parameters are included. The report reprints for convenience, summaries of capital cost by account type developed in the previous commercial electric-power cost studies. DOE

N79-29664# Main (Charles T.), Inc., Boston, Mass.
UNDERGROUND HYDROELECTRIC PUMPED STORAGE: AN EVALUATION OF THE CONCEPT Final Report
Nov. 1978 354 p refs
(Contract EC-77-C-01-2133)
(TID-29412) Avail: NTIS HC A16/MF A01

A contribution to the Bureau of Reclamation's Underground Hydroelectric Pumped Storage (UHPS) Program is presented. The state-of-the-art through research and developmental work was enhanced. The review consisted of an evaluation of the technical feasibility and economic viability of UHPS, identification for further research, and recommendation for a continuing program of development. DOE

N79-29665# California Univ., Livermore. Lawrence Livermore Lab.
DOE/STOR BIBLIOGRAPHY FOR FLYWHEEL ENERGY SYSTEMS, 1977
B. Mallon and R. W. Kuhn 5 Jan. 1979 330 p
(Contract W-7405-eng-48)
(UCRL-52637) Avail: NTIS HC A15/MF A01

Five hundred and fifty-five selected references to the world literature through December 1977 are presented. It includes citations that describe flywheel designs, properties and materials, and the actual and contemplated applications of flywheels in vehicles, utilities, aircraft, and spacecraft. The citations are selectively grouped according to the subjects mentioned above and organized by author and by date. An alphabetical index of authors is presented as well as a listing of keyphrases organized by subject matter. An alphabetical listing of authors and keyphrases are reported. DOE

N79-29666# Los Alamos Scientific Lab., N. Mex.
NON-ELECTRICAL USES OF THERMAL ENERGY GENERATED IN THE PRODUCTION OF FISSILE FUEL IN FUSION-FISSION REACTORS: A COMPARATIVE ECONOMIC PARAMETRIC ANALYSIS FOR HYBRID WITH OR WITHOUT SYNTHETIC FUEL PRODUCTION

A. S. Tai and R. A. Krakowski 1979 19 p refs Presented at the 3rd US/USSR Symp. on Fusion: Fission Hybrids, Princeton, N.J., 22 Jan. 1979
(Contract W-7405-eng-36)
(LA-UR-79-574; Conf-790117) Avail: NTIS HC A02/MF A01

The sensitivity of the synfuel production cost in relation to crucial economic and technologic quantities (investment costs of hybrid and synfuel plant, energy multiplication of the fission blanket, recirculating power friction of the fusion driver, etc.) was analyzed parametrically. In addition, a minimum synfuel selling price was evaluated, from which the fission-fusion-synfuel complex brings about a higher economic benefit than does the fusion-fission hybrid entirely devoted to fissile fuel and electricity generation. Assuming an electricity cost of 2.7 cents/kWh, an annual investment cost per power unit of 4.2 to 6 $/GJ for the fission-fusion complex and 1.5 to 3 $/GJ for the synfuel plant, the synfuel production net cost varies between 6.5 and 8.6 $/GJ. These costs can compete with those obtained by other processes (natural gas reforming, resid partial oxidation, coal gasification, nuclear fission, solar electrolysis, etc.). DOE

N79-29667# Istituto Superiore di Sanita, Rome (Italy). Lab. delle Radiazioni.
PROBLEMS AND PROSPECTIVES ON SOLAR ENERGY UTILIZATION [PROBLEMI E PROSPETTIVE NELL'UTILIZZAZIONE DELL'ENERGIA SOLARE]
G. CamposVenuti, S. Frullani, E. Tabet, and P. Vecchia 1 Feb. 1978 23 p refs In ITALIAN; ENGLISH summary
(ISS-P-78/1) Avail: NTIS HC A02/MF A01

Some aspects and problems related to the development of solar technologies are discussed. Special attention is devoted to the development outlook for solar electric conversion techniques, mainly via the photovoltaic effect, which is estimated to have the best potential, especially considering the efficiency increase and cost reduction of these devices foreseen in the near future. The particular problems related 10 solar energy development in Italy are discussed separately. Author (ESA)

N79-29668# Open Univ., Milton (England). Energy Research Group.
ALTERNATIVE ENERGY SOURCES: AN ANALYSIS OF THEIR ROLE IN ENERGY POLICY
P. F. Chapman 1978 64 p refs
Avail: NTIS HC A04/MF A01

Combined heat and power, substitute natural gas, solar energy, and wave power are examined then compared with traditional and nuclear energy sources. The study refers to Great Britain's needs and energy policy up to the year 2025. Wave power is shown to be the most attractive potential source. Nuclear power shows poor performance compare other alternatives. A power demand growth rate leveling off at 1 percent per year is assumed. Electric car development is considered very probable and beneficial to rational use energy. Author (ESA)

N79-29669# Laboratoires d'Electronique et de Physique Appliquee, Limeil-Brevannes (France).
SOLAR CELLS MADE FROM POLYCRYSTALLINE SILICON European Concerted Action: Photopiles Solaire Final Report [REALISATION DE CELLULES SOLAIRES A PARTIR DE SILICIUM POLYCRISTALLIN]
E. Fabre Oct. 1978 34 p refs In FRENCH; ENGLISH summary
(Contract DGRST-76-7-1495)
(LEP-78/519-679-D) Avail: NTIS HC A03/MF A01

Three structures were investigated relative to their use as the collecting junction of solar cells made from polycrystalline silicon. These are n + /p homojunction, M.I.S. barrier, heterojunction involving indium oxide. The n + /p homojunction, as obtained using a modified diffusion process, yielded the best result: per cent under AM1 conditions. The paramount influence of the silicon-carbon interface on the conversion efficiency was revealed. An increase of the minority carrier diffusion length was observed as a function of the incident light flux. Author (ESA)

N79-29670# KVB, Inc., Minneapolis, Minn.
FIELD TESTS OF INDUSTRIAL STOKER COAL-FIRED BOILERS FOR EMISSIONS CONTROL AND EFFICIENCY IMPROVEMENT: SITE A (DATA SUPPLEMENT) Supplement Report, Jun. - Dec. 1977
J. E. Gabrielson, P. L. Langsjoen, and T. C. Kosvic Dec. 1978 279 p refs
(Contract EF-77-C-01-2609)
(PB-293731/6; EPA-600/7-78-136B) Avail: NTIS HC A13/MF A01 CSCL 13A

A compilation of test data is presented. Panel board data for each test, detailed particulate, O2, CO2, CO, NO, SO2, and SO3 data, particle size distribution data, modified spoke spot data, and data on chemical analysis of the coal and coal size consistency are included. GRA

N79-29671# Old West Regional Commission, Billings, Mont.
ENERGY RESEARCH INFORMATION SYSTEM, VOLUME 3, NO. 1 (PROJ. NOS. 00001081 THROUGH 00001224)
Catherine A. Boyd, comp. and Laura Schillinger, comp. Aug. 1978 98 p Sponsored in part by DOE and Geol. Survey
(PB-294342/1; OWRC/ERIS-7808) Avail: NTIS HC A02/MF A01 CSCL 10B

An inventory of the energy related programs and research activities from 1974 to the present in the states of Montana, Nebraska, North Dakota, South Dakota, and Wyoming is provided. Coal, petroleum, oil shales, fission fuels, synthetic fuels, hydroenergy, renewable energy resources, energy policy, reclamation, socioeconomic impacts, environmental impacts and land use are topics included. GRA

N79-29672# Old West Regional Commission, Billings, Mont.
ENERGY RESEARCH INFORMATION SYSTEM, VOLUME 3, NO. 2 (PROJECT NOS. 00001225 THROUGH 00001362) Report, Aug. - Dec. 1978
Catherine A. Boyd, comp. and Janet Jelinek, comp. Dec. 1978 117 p Sponsored in part by DOE and Geol. Survey
(PB-294951/9; OWRC/ERIS-7812) Avail: NTIS HC A06/MF A01 CSCL 10B

An inventory of the energy-related programs and research activities from 1974 to the present in the states of Montana, Nebraska, North Dakota, South Dakota and Wyoming, is presented. Areas of research covered include: coal, petroteum, oil shales, fission fuels, synthetic fuels, hydroenergy, renewable energy resources, energy policy, reclamation, socioeconomic impacts, environmental impacts and land use. Each project decription lists title, investigator, research institution, sponsor, funding, time frame, location, a decription abstract of the research and title reports projects are publications generated by the research. All projects are indexed by location, personal names, organizations and subject keywords. GRA

N79-29673# Old West Regional Commission, Billings, Mont.
ENERGY RESEARCH INFORMATION SYSTEM. VOLUME 3, NO. 3: PROJECTS REPORT CUMULATIVE INDEXES Report, Apr. 1977 - Dec. 1978
Catherine A. Boyd, comp. and Janet Jelinek, comp. Jan. 1979 76 p Sponsored in part by DOE and Geol. Survey
(PB-294952/7; OWRC/ERIS-7901) Avail: NTIS HC A05/MF A01 CSCL 10B

The cumulative indexes include a state-location index, a personal name index, and organization index and a subject keyword index incorporating the indexes from ERIS Volume 3, No. 1 and 2 and 3, comprises a set of 1362 research project references for the States of the Old West region. GRA

N79-29674# Executive Office of the President, Washington, D. C. Assistant to the President for Intergovernmental Affairs.
RURAL DEVELOPMENT INITIATIVES: ENERGY FOR RURAL AMERICA
May 1979 24 p
(PB-295234/9) Avail: NTIS HC A02/MF A01 CSCL 10A

The initiatives undertaken to provide energy for rural America are described. These initiatives include small-scale hydroelectric power, the production of natural gas from coal and shale, the production of gasahol from renewable agricultural products, and the use of wood as a source of energy. GRA

N79-29675# Auburn Univ., Ala. Water Resources Research Inst.
THE EFFECT OF WATER POLLUTION CONTROL REGULA-

TIONS ON THE COST OF PRODUCTION OF ELECTRIC POWER Final Report
Timothy A. Deyak and Albert N. Link Mar. 1979 33 p refs
(PB-294270/4; WRRI-Bull-36; W79-05796;
OWRT-A-062-ALA(1)) Avail: NTIS HC A03/MF A01 CSCL 13B

The impact of water pollution control regulations, such as those outlined in 1972 FWPCA Amendments, on production costs in the electric utility industry are examined. The use of water by electric utilities, and the impact that water regulations will have on those uses are discussed. The production process of electric utilities is discussed, and a cost function from a cross-section sample of utility plants for the year 1973 is empirically estimated. It is this cost function which allows the evaluation the impact of increased regulation on the cost of production. GRA

45 ENVIRONMENT POLLUTION

Includes air, noise, thermal and water pollution; environment monitoring; and contamination control.

N79-29676 Maryland Univ., College Park.
METHODS FOR THE DETERMINATION OF ATMOSPHERIC TETRAALKYLLEAD AND ALKYL SELENIDE SPECIES USING A GC-MICROWAVE PLASMA DETECTOR Ph.D. Thesis
Donald Charles Reamer 1978 283 p
Avail: Univ. Microfilms Order No. 7917138

A study was undertaken to ascertain the importance of atmospheric tetraalkyllead levels and determine the species with respect to vehicle exhaust emissions and to better understand the importance of microbially produced alkyl selenides to atmospheric Se levels. Reliable collection methods for the two types of compounds were developed using Spherocarb, a carbon molecular sieve, for dimethyl selenide and colled silicon rubber SE-52 (5% phenyl) on 60/80 mesh Chromosorb P for the five TAL compounds. The Gas Chromatograph-Microwave Plasma Detector system was built with a background-correction system using a wavelength modulation technique, specifically for the analysis of Pb and Se compounds. Dissert. Abstr.

N79-29677 Washington Univ., Seattle.
A NUMERICAL MODEL OF PARTICLE INTERACTIONS IN THE PLUMES Ph.D. Thesis
Mark Willkie Eltgroth 1978 188 p
Avail: Univ. Microfilms Order No. 7917558

A series of detailed airborne measurements are presented of particle size distribution at various locations in the plumes from two large coal-fired electric power plants situated in quite different geographical regions (Washington State and New Mexico). A three-dimensional numerical model model is described which considers the effects of advection, diffusion, coagulation, gravitational settling, gas-to-particle (g-to-p) conversion and interactions with the ambient air on the evolution with time of particle size distribution in power plant plumes. Dissert. Abstr.

N79-29678*# Spectrix Corp., Houston, Tex.
DEVELOPMENT OF RECLAIMED POTABLE WATER QUALITY CRITERIA Final Report, 29 Jul. 1977 - 31 Dec. 1978
Donald A. Flory and Francis W. Weir 1979 103 p refs
(Contract NAS9-15368)
(NASA-CR-160281) Avail: NTIS HC A06/MF A01 CSCL 13B

In order to minimize launch requirements necessary to meet the demands of long-term spaceflight, NASA will reuse water reclaimed from various on-board sources including urine, feces, wash water and humidity condensate. Development of reclamation systems requires the promulgation of water quality standards for potable reuse of the reclaimed water. Existing standards for domestic U.S. potable water consumption were developed, but do not consider the peculiar problems associated with the potable reuse of recycled water. An effort was made to: (1) define a protocol by which comprehensive reclaimed water potability/palatability criteria can be established and updated; and (2) continue the effort to characterize the organic content of reclaimed water in the Regenerative Life Support Evaluation. G.Y.

N79-29679*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
SPATIAL-FREQUENCY RESPONSE OF THE LIMB INFRARED MONITOR OF THE STRATOSPHERE
R. Gale Wilson, Anthony Jalink, Jr., and William M. Kahlbaum, Jr. Aug. 1979 52 p refs
(NASA-TP-1504; L-13037) Avail: NTIS HC A04/MF A01 CSCL 13B

Measurements from the Limb Infrared Monitor of the stratosphere (LIMS) are presented and discussed. From the LIMS design model data, the modulation transfer function (MTF) was calculated for the optical system, the detector field mask, the electronics, and the overall system for each channel. The signal output performance of the instrument was predicted from the system MTF data and model input radiance data for each channel. The MTF measurements made on the flight sensor confirmed the analytical results. R.E.S.

N79-29680*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
LAUNCH VEHICLE EFFLUENT MEASUREMENTS DURING THE SEPTEMBER 5, 1977, TITAN 3 LAUNCH AT AIR FORCE EASTERN TEST RANGE
Dewey E. Wornom, Richard J. Bendura, and Gerald L. Gregory Aug. 1979 130 p refs
(NASA-TM-80065; L-12813) Avail: NTIS HC A07/MF A01 CSCL 13B

Airborne effluent measurements and cloud physical behavior data are presented. The monitoring program included airborne effluent measurements in situ in the launch cloud, visible and infrared photography of cloud growth and physical behavior, and limited surface collection of rain samples. Effluent measurements included concentrations of HCl, Cl2, NO, nitric oxide, and particles as a function of time in the exhaust cloud. In situ particle mass concentration and number density were measured as a function of time and size in the range of 0.05 micron m to 30 micron m diameter. Measurement results were similar to those of previous launch monitorings. Maximum HCl and nitric oxide concentrations of Cl2 were maximum about 2 minutes after launch and by 10 to 15 minutes had decayed to less than 10 ppb (detection limit). Particle measurements showed most of the particles present to be below about 3-micron m diameter. Postlaunch analyses of collected particle samples showed significant amounts of Al (some cases Cl) from about 3-micron m to 0.04-micron m diameter. A.R.H.

N79-29681# George Washington Univ., Washington, D. C. Program in Logistics.
OPTIMAL TREATMENT LEVELS OF A STREAM POLLUTION ABATEMENT SYSTEM UNDER THREE ENVIRONMENTAL CONTROL POLICIES. PART 1: SOLUTION AND ANALYSIS OF CONVEX EQUIVALENTS OF ECKER'S GP MODELS USING SUMT
Anthony V. Fiacco and Abolfazl Ghaemi 19 Jan. 1979 58 p refs
(Contract N00014-75-C-0729; NR Proj. 347-020)
(AD-A068313; SERIAL-T-387) Avail: NTIS HC A04/MF A01 CSCL 13/2

The existing approaches to the mathematical modeling and optimization of a water pollution problem are briefly surveyed. A proposed geometric programming model of a water pollution and treatment system, which easily lends itself to the theory and application of nonlinear programming sensitivity analysis techniques, is studied in detail. As in previous work by the author of the model, the optimal waste treatment facilities along the Upper Hudson River are presented for three different environmental policies, leaving the sensitivity analysis study for a following report. Previous results were obtained using a geometric programming code, while the present study makes use of the SUMT code. It is shown that the policy of fixed dissolved oxygen requirement yields the mininum annual waste treatment cost, relative to two other policies. Moreover, it is shown that a variable dissolved oxygen policy yields relatively uniform treatment levels in the treatment plants at appreciablely reduced cost compared to the costs involved in strict uniform

treatment policy. the results of the present study are consistent with, but not identical to, the finding reported in previous work. The discrepancy in the coefficients involved in the dissolved oxygen constraints used by these two studies is the main reason for the differences observed. A listing of a computer program developed to calculate these coefficients is included. GRA

N79-29682# State Univ. of New York Coll. at Fredonia.
ENVIRONMENTAL IMPACT OF COAL ASH ON TRIBUTARY STREAMS AND NEARSHORE WATER OR LAKE ERIE Final Report
K. G. Wood Aug. 1978 73 p refs
(Contract E(11-1)-2726-2)
(COO-2726-5) Avail: NTIS HC A04/MF A01

The environmental impact of coal ash disposal at a landfill site in north-central Chautauqua County, New York was studied from June 1975 through July 1977. Water samples taken from wells, ponds, and streams at 67 sites were analyzed for specific conductance, pH, alkalinity, arsenic, calcium, cadmium, chloride, chromium, copper, iron, magnesium, manganese, potassium, selenium, sodium, sulfate and zinc. Evidence suggests that ponds at the landfill were high in Ca, Fe, Mg, and SO4 compared to control ponds. No harmful effects could be demonstrated on the biota in the creek which flowed past the disposal area. DOE

N79-29683# Arizona State Univ., Tempe. Coll. of Mines.
POLLUTANT CONTROL THROUGH STAGED COMBUSTION OF PULVERIZED COAL
J. O. L. Wendt, J. W. Lee, and J. W. Glass Jun. 1978 26 p refs
(Contract EX-76-C-01-1817)
(FE-1817-5) Avail: NTIS HC A03/MF A01

A 2Kg/h pulverized-fuel, plane-flame combustor was used to determine time-resolved NO profiles under fuel rich and staged combustion conditions. Seven solid fuels, including two coal chars, were investigated. Results show that at all fuel rich conditions NO is formed rapidly and then is slowly destroyed. The peak NO value and the rate of destruction are strong functions of coal composition and stoichiometry. Under staged combustion conditions, NO may increase or decrease at the staging point depending on the fuel and on the quantity of NO formed in the first stage. Use of artificial oxidants confirmed that the NO formed in the first and second stages consisted of fuel NO. Heterogeneous formation and reduction of NO during char combustion was modeled by a two reaction scheme. Heterogeneous reduction was less than first order in NO and had an activation energy of 47 kcal/mole. The roles of devolatilization and homogeneous reactions are discussed in the light of the data presented. DOE

N79-29684# California Univ., Berkeley. Lawrence Berkeley Lab.
SECOND GENERATION DICHOTOMOUS SAMPLER FOR LARGE-SCALE MONITORING OF AIRBORNE PARTICULATE MATTER
B. W. Loo, R. S. Adachi, C. P. Cork, F. S. Goulding, J. M. Jaklevic, D. A. Landis, and W. L. Searles Jan. 1979 21 p refs Presented at 86th AICE Meeting, Houston, Tex., 1 Apr. 1979
(Contract W-7405-eng-48)
(LBL-8725; Conf-790405-13) Avail: NTIS HC A02/MF A01

The differences which exist between fine (less than 2.5 microns) and coarse (greater than 2.5 microns) airborne particles with respect to their origin, chemical properties, and environmental impact, call for their separate collection and analysis. An automated dichotomous sampler equipped with a high efficiency single-stage virtual impactor and a microprocessor-based controller to self-correct fault conditions including filter overload, were developed as a model for commercial production. DOE

N79-29685# Battelle Columbus Labs., Ohio.
PERFORMANCE EVALUATION OF A SOLID SORBENT HYDROCARBON SAMPLER Final Report
Maynard B. Neher, Peter W. Jones, and Patrice J. Perry Jan. 1979 57 p refs
(EPRI-EA-959) Avail: NTIS HC A04/MF A01

The solid sorbent sampler was originally developed to collect polycyclic organic materials (POMs) from gaseous power plant effluents. The sampler's collection efficiency and analytic performance for POMs was verified and its use for other vapor phase organic compounds was investigated under a variety of conditions. One set of experiments was carried out under conditions chosen to simulate a power plant stack. The variables studied were sampler temperature, organic compound level, and concentrations of sulfur dioxide, nitric oxide, and water vapor. A second set of experiments was run under conditions chosen to simulate ambient atmosphere conditions. The variables studied were sampler temperature, organic compound loading, and relative humidity. Organic compounds likely to be found in ambient air samples were used. Recoveries were determined by extraction of the sampler bed with pentane and analysis of the extract by gas chromatography or gas chromatography combined with mass spectrometry. DOE

N79-29686# Acurex Corp., Mountain View, Calif. Energy and Environmental Div.
INVESTIGATION OF EMERGING TECHNOLOGY FOR HYDROCARBON AND PARTICULATE EMISSIONS FROM THE STATIONARY SOURCES Final Report
B. Beecham, B. Fulton, and L. Broz Feb. 1979 60 p refs
(Contract EPA-68-01-4142)
(PB-294467/6; ACUREX-79/332; EPA-85/359-8) Avail: NTIS HC A04/MF A01 CSCL 13B

The control technologies that are or may become commercially available by 1985 for stationary hydrocarbon and particulate emissions sources are identified. A matrix of applicable control techniques, percent emission reductions achievable, schedules of availability, and costs are detailed. The most advanced control technology for most ducted emissions from particulate sources was found to be fabric filters and electrostatic precipitators. Hydrocarbon control techniques that offer the potential for reducing emissions through 1985 and beyond are included. GRA

N79-29687*# Martin Marietta Corp., Baltimore, Md. Environmental Center.
ASSESSMENT OF PLUME RISE AND DISPERSION MODELS USING LIDAR DATA Final Report
Jeffrey C. Weil Feb. 1979 83 p refs Sponsored by NASA and Power Plant Siting Program
(NASA-CR-157447; PB-293673/0; PPSP-MP-24) Avail: NTIS HC A05/MF A01 CSCL 04A

Mathematical models for plume rise and dispersion to field measurements of plume rise and dispersion at the Morgantown power plant were compared. Lidar measurements of aerosol density, ground level measurements of SO2, and vertically integrated SO2 concentrations were gathered. GRA

N79-29688# Maryland Dept. of Natural Resources, Annapolis. Power Plant Siting Program.
POWER PLANT CUMULATIVE ENVIRONMENTAL IMPACT REPORT Final Report
Nov. 1978 324 p refs Sponsored in part by Md. Dept. of Health and Mental Hygiene, Md. Dept. of Econ. and Community Develop., Md. Dept. of State Planning, and Md. Public Serv. Comm.
(PB-293804/1; PPSP/CEIR-2) Avail: NTIS HC A14/MF A01 CSCL 13B

The results of studies within the state of Maryland on the environmental effects of power plants are reported. Topics covered are energy and electric power supply, air quality, aquatic impact, radiological effects, socioeconomic impacts, transmission lines, groundwater usage, and cooling towers. Recommendations are made for legislation and/or changes in state policy as a result of the review. GRA

N79-29689# GEOMET, Inc., Gaithersburg, Md.
POWER PLANTS STACK PLUMES IN COMPLEX TERRAIN: DESCRIPTION OF AN AEROMETRIC FIELD STUDY Interim Report, Apr. 1976 - Oct. 1978
Robert C. Koch, W. Gale Biggs, Douglas Cover, Harry Rector, Paul F. Stenberg, and Kenneth E. Pickering Jan. 1979 172 p refs
(Contract EPA-68-02-2260)
(PB-239666/4; GEOMET-EF-678-5125; EPA-600/7-79-010A; EPA/DF-79/003A) Avail: NTIS HC A08/MF A01 CSCL 13B

Air quality and meteorological data collected, processed, and edited are presented. The fixed-station files contain hourly averages of SO2, NOx, NO2, and NO along with wind and temperature data. Ground mobile files contain pollutant and meteorological data from both stationary and mobile monitoring modes. The airborne files are in the form of a series of traverses across the plume between specified check points. Sulfate measurements were taken at selected times at the fixed stations and by mobile van. The upper air file contains pibal and T-sonde observations of vertical profiles of temperature, wind speed, and direction. Hourly emission rates of SO2 and NO along with generator loads and stack data are contained on the plant operations file. GRA

N79-29690# Environmental Sciences Research Lab., Research Triangle Park, N.C.

CURRENT METHODS TO MEASURE ATMOSPHERIC NITRIC ACID AND NITRATE ARTIFACTS

Robert K. Stevens Mar. 1979 99 p refs
(PB-294098/9; EPA-600/2-79-051) Avail: NTIS HC A05/MF A01 CSCL 07D

Presentations given at a workshop on Measurement of Atmospheric Nitrates (Southern Pines, N.C. October 3-4, 1978) are documented. The authors consider various analytical methods to measure ambient concentrations of nitric acid and artifact nitrate formation are presented. GRA

N79-29691# Wyoming Univ., Laramie.

METHODS DEVELOPMENT FOR ASSESSING AIR POLLUTION CONTROL BENEFITS. VOLUME 1: EXPERIMENTS IN THE ECONOMICS OF AIR POLLUTION EPIDEMIOLOGY Final Report, Oct. 1976 - Oct. 1978

Thomas D. Crocker, William D. Schulze, Shaul Ben-David (New Mexico Univ., Albuquerque), and Allen V. Kneese (Resources for the Future, Wash., D. C.) Feb. 1979 177 p refs
(Grant EPA-R-805059-01)
(PB-293615/1; EPA-600/5-79-001A-Vol-1) Avail: NTIS HC A09/MF A01; also available in set of 5 reports HC E14 as PB-293614-SET CSCL 06F

The volume employs the analytical and empirical methods of economics to develop hypotheses on disease etiologies and to value labor productivity and consumer losses due to air pollution-induced mortality and morbidity. In the mortality work, 1970 city-wide mortality rates for major disease catagories were statistically associated with aggregate data from sixty U.S. cities on physicians per capita, per capita cigarette consumption, dietary habits, air pollution and other factors. The estimated effect of air pollution on mortality rates is about an order of magnitude lower than some other estimates. Nevertheless, rather small but important associations are found between pneumonia and bronchitis and particulates in air and between early infant disease and sulfur dioxide air pollution. GRA

N79-29692# California Univ., Riverside.

METHODS DEVELOPMENT FOR ASSESSING AIR POLLUTION CONTROL BENEFITS. VOLUME 4: STUDIES ON PARTIAL EQUILIBRIUM APPROACHES TO VALUATION OF ENVIRONMENTAL AMENITIES Final Report, Oct. 1976 - Oct. 1978

Maureen L. Cropper, William R. Porter, Berton J. Hansen, Robert A. Jones, and John G. Riley Feb. 1979 103 p refs
(Grant EPA-R-805059-01)
(PB-293618/5; EPA-600/5-79-001D-Vol-4) Avail: NTIS HC A06/MF A01; also available in set of 5 reports HC E14 as PB-293614-SET CSCL 06F

The adjustments and changes in underlying assumptions the values would require if they were to be derived in a general equilibrium framework are considered. A second purely theoretical paper examines the impact upon the aforementioned partial equilibrium valuations under variation in consumer uncertainty about the health hazards associated with various forms of consumption. A new model of the variations in wages for assorted occupations across cities is tested to establish an estimate of willingness to pay for environmental amenities. The volume concludes with a report of a small experiment intended to test a particular way to remove any biases that bidding game respondents have to distort their true valuations. GRA

N79-29693# Wyoming Univ., Laramie.

METHODS DEVELOPMENT FOR ASSESSING AIR POLLUTION CONTROL BENEFITS. VOLUME 5: EXECUTIVE SUMMARY Final Report, Oct. 1976 - Oct. 1978

David S. Brookshire, Thomas D. Crocker, Ralph C. Darge, Shaul Ben-David (New Mexico Univ., Albuquerque), Allen V. Kneese (New Mexico Univ., Albuquerque), and William D. Schulze (Univ. of Southern Calif., Los Angeles) Feb. 1979 33 p refs
(Grant EPA-R-805059-01)
(PB-293619/3; EPA-600/5-79-001E-Vol-5) Avail: NTIS HC A03/MF A01; also available in set of 5 reports HC E14 as PB-293614-SET CSCL 06F

The first four volumes summarized by this volume represent original efforts to construct both a conceptually consistent and empirically verifiable set of methods for assessing the economic benefits of air quality improvements. While the state-of-the-art does not at present allow highly accurate estimates of the benefits of reduced human or plant exposure to air pollutants, these studies nevertheless provide a set of fundamental benchmarks on which further efforts might be built. These are: (1) many benefits traditionally viewed as intangible and therefore nonmeasurable can, in fact, be measured and be made comparable to economic values as expressed in markets; (2) aesthetic and morbidity effects may dominate the measure of benefits as opposed to previous emphases on mortality health effects; and (3) the likely economic benefits of air quality improvements are perhaps as much as an order of magnitude greater than previous studies had hypothesized. GRA

N79-29694# SRI International Corp., Menlo Park, Calif.

THE EFFECTS OF OZONATION REACTIONS IN WATER, VOLUME 1 Final Report

Vincent F. Simmon and Ronald J. Spanggord Mar. 1979 212 p refs 2 Vol.
(PB-294795/0; LSU-4316-Vol-1) Avail: NTIS HC A10/MF A01 CSCL 06T

The potential biological hazard of ozonation was evaluated by using rapid microbial bioassays of selected organic compounds under ozonation conditions. Twenty-nine compounds were evaluated for mutagenic activity before and after ozonation using the Ames Salmonella/microsome and the yeast Saccharomyces cerevisiae D3 assays. GRA

N79-29695# SRI Internationsl Corp., Menlo Park, Calif.

THE EFFECTS OF REACTIONS OF CHLORINE DIOXIDE IN WATER, VOLUME 2 Final Report

Vincent F. Simmon, Ronald J. Spanggord, Sharon L. Eckford, and Vernon McClurg Mar. 1979 183 p refs 2 Vol.
(Contract EPA-68-01-2894)
(PB-294796/8; LSU-4316-Vol-2) Avail: NTIS HC A09/MF A01 CSCL 06T

The results of the evaluation of twenty-six compounds for mutagenic activity before and after treatment with chlorine dioxide are reported. Two biological assays, the Ames Salmonella/microsome and the yeast Saccharomyces cerevisiae D3 assays, were used to determine the mutagenic activity of each compound. GRA

N79-29696# Harvard Univ., Cambridge, Mass. Landscape Architecture Research Office.

THE INTERACTION BETWEEN URBANIZATION AND LAND QUALITY AND QUANITY IN ENVIRONMENTAL PLANNING AND DESIGN. THE DATA BASE, TECHNICAL DOCUMENTATIONS

Carl Steinitz, Charles J. Frederick, and Peter Goodale Dec. 1978 162 p refs 2 Vol.
(Grant NSF ENV-72-03372)
(PB-294154/0; NSF/RA-780416) Avail: NTIS HC A08/MF A01 CSCL 13B

The data base described provides an efficient, accurate, easily used and flexible system to meet the information needs of the various component models of the research effort. The basic unit used to construct the data base is a grid cell of one hectare (2.47 acres). The study area contains 75,600 cells, over half of which represent land undeveloped in 1973. The data base contains four types of data: physiographic and natural systems, man made elements of land use and land cover, data associated with political jurisdictions and functional zones and data created by combina-

tions of the first three types and/or derived from the operation of the models. GRA

N79-29697# Harvard Univ., Cambridge, Mass. Landscape Architecture Research Office.
THE INTERACTION BETWEEN URBANIZATION AND LAND QUALITY AND QUANTITY IN ENVIRONMENTAL PLANNING AND DESIGN. LAND USE DESCRIPTORS, TECHNICAL DOCUMENTATION
Douglas S. Way Dec. 1978 82 p refs 2 Vol.
(Grant NSF ENV-72-03372)
(PB-294155/7; NSF/RA-780417) Avail: NTIS HC A05/MF A01 CSCL 13B

The land use descriptors define and summarize the characteristics of land uses that may be developed in a region as it becomes urbanized. The evaluation models associated with the research project react to the various construction, maintenance, or use characteristics of land uses. The tables provide for uniform definitions. Information for each use includes a prototype photograph, plan, characteristics of cover, construction, consumption-emission, and building costs. Each land use was coded by the three digit land use code. GRA

N79-29698# Environmental Sciences Research Lab., Research Triangle Park, N.C.
USER'S GUIDE FOR RAM. VOLUME 1: ALGORITHM DESCRIPTION AND USE
D. Bruce Turner and Joan Hrenko Novak Nov. 1978 70 p refs 2 Vol.
(PB-294791/9; EPA-600/8-78-016A-Vol-1) Avail: NTIS HC A04/MF A01 CSCL 13B

A method of estimating short term dispersion using the Gaussian steady state model is described. These algorithms can be used for estimating air quality concentrations of relatively nonreactive pollutants for averaging times from an hour to a day from point and area sources. The algorithms are applicable for locations with level or gently rolling terrain where a single wind vector for each hour is a good approximation to the flow over the source area considered. Hourly meteorological data required are wind direction, wind speed, temperature, stability class, and mixing height. Emission information required of point sources consists of source coordinates, emission rate, physical height, stack diameter, stack gas temperature. Emission information required of area sources consists of southwest corner coordinates, source side length, total area emission rate and effective area source-height. GRA

N79-29699# Environmental Sciences Research Lab., Research Triangle Park, N.C.
USER'S GUIDE FOR RAM. VOLUME 2: DATA PREPARATION AND LISTINGS
D. Bruce Turner and Joan Hrenko Novak Nov. 1978 232 p refs 2 Vol.
(PB-294792/7; EPA-600/8-78-016B-Vol-2) Avail: NTIS HC A11/MF A01 CSCL 13B

Algorithms used for estimating air quality concentrations of relatively nonreactive pollutants for averaging times from an hour a day from point and area sources are considered. The algorithms are applicable for locations with level or gently rolling terrain where a single wind vector for each hour is a good approximation to the flow over the source area considered. Example outputs, typical run streams, variable glossaries, and Fortran source codes are presented. GRA

N79-29700# Harvard Univ., Cambridge, Mass. Landscape Architecture Research Office.
THE INTERACTION BETWEEN URBANIZATION AND LAND: QUALITY AND QUANTITY IN ENVIRONMENTAL PLANNING AND DESIGN. THE CONSERVATION MODEL
Carl Steinitz and Cheryl Barton Dec. 1978 159 p refs
(Grant NSF ENV-72-03372)
(PB-294483/3; NSF/RA-780422) Avail: NTIS HC A08/MF A01 CSCL 13B

The conservation model determines the effects of diverse state and local priorities, as well as various funding policies, upon the decision to purchase conservation land. The model simulates land conservation actions that may occur in the future based on the past and present values of those persons and groups charged with their provision. The model ranks and allocates those areas in which conservation would protect the greatest number of these resource attributes as weighted by the user and by cost. GRA

N79-29701# Harvard Univ., Cambridge, Mass. Landscape Architecture Research Office.
THE INTERACTION BETWEEN URBANIZATION AND LAND: QUALITY AND QUANTITY IN ENVIRONMENTAL PLANNING AND DESIGN. AIR QUALITY EVALUATION
Peter Rogers and Philip McClellan Jan. 1979 79 p refs
(Grant NSF ENV-72-03372)
(PB-294564/0; NSF/RA-780431) Avail: NTIS HC A05/MF A01 CSCL 13B

Three pollutants were selected as indicators of air quality: particulates and sulfur dioxide were the indicators for point and area sources, while carbon monoxide was used to measure mobile source emissions. The methods used to relate emissions to concentrations were based on the Gaussian plume dispersion equation, and evaluations were then compared with Environmental Protection Agency standards. GRA

N79-29702# Harvard Univ., Cambridge, Mass. Landscape Architecture Research Office.
THE INTERACTION BETWEEN URBANIZATION AND LAND: QUALITY AND QUANTITY IN ENVIRONMENTAL PLANNING AND DESING. SOLID WASTE MANAGEMENT
Peter Rogers and Philip McClellan Jan. 1979 29 p refs
(Grant NSF ENV-72-03372)
(PB-294563/2; NSF/RA-780425) Avail: NTIS HC A03/MF A01 CSCL 13B

Resource recovery is addressed as a method of approaching the solid waste problem. It is assumed that the basic technology used will be that of sanitary landfilling or export out of the region and that it will be pursued on a town-by-town basis until the turn of the century when some form of regional facility may be economically justified. Development pressures, population growth, and shortages of available sites should eventually bring about some form of regionalization of disposal facilities. This model works to determine the amount of time left before this situation arises; it assesses the viability of town landfills given predicted demand through the year 2000. GRA

N79-29703# Harvard Univ., Cambridge, Mass. Landscape Architecture Research Office.
THE INTERACTION BETWEEN URBANIZATION AND LAND: QUALITY AND QUANTITY IN ENVIRONMENTAL PLANNING AND DESIGN. THE LEGAL/IMPLEMENTATION MODEL
William Giezentanner and Carl Steinitz Dec. 1978 148 p refs
(Grant NSF ENV-72-03372)
(PB-294487/4; NSF/RA-780437) Avail: NTIS HC A07/MF A01 CSCL 13B

The Legal/Implementation Model has three major roles: to constrain allocations of land uses in accordance with state, local and federal land use controls, to allow automatic retrieval of summaries of legal statutes controlling land uses and activities, and to evaluate allocations for their conformance with land use and environmental quality laws. The model consists of three parts: (1) an automated library of legal summaries; (2) a set of legal constraints which control land use allocations; and (3) a series of evaluations based on particular laws. GRA

N79-29704# Harvard Univ., Cambridge, Mass. Landscape Architecture Research Office.
THE INTERACTION BETWEEN URBANIZATION AND LAND: QUALITY AND QUANTITY IN ENVIRONMENTAL PLANNING AND DESIGN. THE HISTORICAL RESOURCES MODEL
Carl Steinitz and Karl Haglund Dec. 1978 70 p refs
(Grant NSF ENV-72-03372)
(PB-294486/6; NSF/RA-780433) Avail: NTIS HC A04/MF A01 CSCL 13B

The historical resources model evaluates the specific and unique, often qualitative, values of buildings and areas. The evaluation is based upon an extensive inventory undertaken by the research team, and checked against inventories conducted by various local historic associations and individuals. For unprotected historic resources, the principal public means of

affording protection is through conservation expenditures. The historic resources model therefore provides input to the conservation model as a critical resource, or a resource worth conserving. It also monitors and evaluates the impacts of development, both in terms of the direct impact of physical loss of historic landmarks and structures and their indirect degradation due to changes in the visual quality of their surroundings. GRA

N79-29705# Harvard Univ., Cambridge, Mass. Landscape Architecture Research Office.
THE INTERACTION BETWEEN URBANIZATION AND LAND: QUALITY AND QUANTITY IN ENVIRONMENTAL PLANNING AND DESIGN. THE SOILS MODEL
Douglas S. Way Dec. 1978 138 p refs
(Grant NSF ENV-72-03372)
(PB-294485/8; NSF/RA-780426) Avail: NTIS
HC A07/MF A01 CSCL 13B

The soil evaluation models were developed to provide useful information for making planning decisions related to soil resources. The U.S. Department of Agriculture's Universal Soil Loss Equation was integrated and adapted so that implications of land use construction on soil erosion and subsequent sedimentation in wetland and water features can be determined for any land use or proposed plan. The model also contains the ability to indicate relevant performance standards and associated cost necessary to reduce erosion or sedimentation to a defined tolerable level. GRA

N79-29706# Harvard Univ., Cambridge, Mass. Landscape Architecture Research Office.
THE INTERACTION BETWEEN URBANIZATION AND LAND: QUALITY AND QUANTITY IN ENVIRONMENTAL PLANNING AND DESIGN. THE RECREATION MODEL
Carl Steinitz and Douglas Allen Jan. 1979 98 p refs
(Grant NSF ENV-72-03372)
(PB-294484/1; NSF/RA-780423) Avail: NTIS
HC A05/MF A01 CSCL 13B

The recreation allocation model determines suitable sites for recreational development and allocates recreation projects subject to recreational policies and to budget and other constraints. This is accomplished through the use of indices which rate each available hectare as to suitability for a given number of recreational activities. Aggregates of suitable hectares are clumped to form potentially suitable project sites. These potential projects are then ranked in a ratio of relative benefits to costs. Acquisitions can then be chosed that yield the greatest benefit at the least cost, given the policy and budget constraints of the state or each town in the study area. GRA

N79-29707# Battelle Columbus Labs., Ohio.
IDENTIFICATION OF ORGANIC COMPOUNDS IN INDUSTRIAL EFFLUENT DISCHARGES Final Report, Sep. 1976 - Oct. 1978
D. L. Perry, C. C. Chuang, G. A. Jungclaus, and J. S. Warner Feb. 1979 243 p refs
(PB-294794/3; EPA-600/4-79-016) Avail: NTIS
HC A11/MF A01 CSCL 07D

Samples of 63 effluent and 22 intake waters were collected from a wide range of chemical manufacturers in areas across the United States. The samples were analyzed for organic compounds in an effort to identify previous unknown and potentially hazardous organic pollutants. Each water sample was preconcentrated for analysis of organic compounds in four fractions: volatile organics by helium-gas stripping and semivolatile organics by extraction with methylene chloride resulting in separate neutral, acidic and basic fractions. All sample analyses involved a GC/MS/COMP system that used high resolution glass capillary GC columns. Organic constituents were identified using the computerized Biemann mass spectral matching system together with some manual interpretation and qualified using GC-FID peak area determinations. Over 570 compounds were tentatively identified of which 33 are priority pollutants. Generally, industrial effluents contained few priority pollutants. Most of the components found in the effluents were specific for a particular industrial site and did not appear in reoccurring patterns. GRA

N79-29708# TRW Systems Group, Redondo Beach, Calif.
EMISSIONS ASSESSMENT OF CONVENTIONAL STATIONARY COMBUSTION SYSTEMS: METHODS AND PROCEDURES MANUAL FOR SAMPLING AND ANALYSIS Final Report, Sep. 1976 - Dec. 1978
J. W. Hamersma, D. G. Ackerman, M. M. Yamada, C. A. Zee, and C. Y. Ung Jan. 1979 421 p refs
(Contract EPA-68-02-2197)
(PB-294675/4; EPA-600/7-79-029A) Avail: NTIS
HC A18/MF A01 CSCL 07D

A detailed and integrated set of sampling and analytical procedures for conventional combustion sources which are compatible with the information requirements of a comprehensive Level 1 environmental assessment are described. The emission factors for conventional stationary combustion sources are provided. Quality assurance, sample and data management, field sampling, field analysis, organic analysis, and inorganic analysis are discussed. GRA

N79-29709# North Carolina Univ. at Chapel Hill. Dept. of Environmental Sciences and Engineering.
ASSESSMENT OF COAL CONVERSION WASTE-WATERS: CHARACTERIZATION AND PRELIMINARY BIOTHREATABILITY Technical Report, Nov. 1976 - May 1978
P. C. Singer, F. K. Pfaender, J. Chinchilli, A. F. Maciorowski, and J. C. Lamb, III Sep. 1978 116 p refs
(Grant EPA-R-804917)
(PB-294338/9; EPA-600/7-78-181) Avail: NTIS
HC A06/MF A01 CSCL 13B

Characteristics of coal conversion wastewaters were obtained from the literature and from information gathered during visits to facilities for coal conversion process development. About 60-80% of total organic carbon is phenolic. Remaining organic material includes, nitrogen-containing aromatics, oxygen and sulfur-containing heterocyclics, polynuclear aromatic hydrocarbons, and simple aliphatic acids. A synthetic wastewater was formulated which includes 28 organic compounds, inorganic nutrients, and pH buffering additives. For each class of compounds in real wastewaters, one or more representatives are in the synthetic wastewater at the appropriate mean concentrations. Experiments are underway using the synthetic wastewater at quarter strength in four 25-liter biological treatment units. These units are to test biodegradability as a function of retention time and produce acclimated microorganisms for use in respirometric studies. GRA

N79-29710# California State Dept. of Transportation, Sacramento. Office of Transportation Lab.
WATER POLLUTION ASPECTS OF PARTICLES WHICH COLLECT ON HIGHWAY SURFACES Final Report
Richard B. Howell Jul. 1978 152 p Sponsored in part by DOT
(PB-294609/3; TL-657117; FHWA/CA-78/22) Avail: NTIS
HC A08/MF A01 CSCL 13B

Findings from a study of constituents in pavement runoff waters at I-405 Los Angles, I-680 Walnut Creek, and Route 50 Placerville are presented. Discrete samples were obtained at various times during storm runoff and tested. Some 34 different physical, chemical, and biological parameters were measured. GRA

46 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.

For space radiation see *93 Space Radiation*.

N79-29711 Washington Univ., Seattle.
A NUMERICAL AND OBSERVATIONAL STUDY OF AFRICAN DISTURBANCES Ph.D. Thesis
Clifford Mass 1978 296 p
Avail: Univ. Microfilms Order No. 7917607

The life cycle of African wave disturbances was examined. Synoptic and spectral analysis techniques were applied for the data rich years of 1962 and 1963 in order to define the region(s) and conditions of disturbance origin. The disturbances are formed in the central and eastern Sudan as a result of the barotropic instability of the midtropospheric easterly jet. A linear,

ten level primitive equation channel model with boundary layer friction, convective heating and cumulus momentum mixing was used to determine if the unstable perturbations growing on realistic mean states approximate the observed disturbance fields and energetic. It was found that a realistic mean jet profile, constructed from a one week average of the zonal wind at 5 degrees E, produced a most unstable mode with propagation and structural characteristics close to the observed. Dissert. Abstr.

N79-29712 Washington Univ., Seattle.
A COMPARISON OF SOME NATURAL AND ANTHROPOGENIC SOURCES OF PARTICLES AND GASES IN THE ATMOSPHERE Ph.D. Thesis
Jeffrey Len Stith 1978 208 p
Avail: Univ. Microfilms Order No. 7917642

A series of airborne measurements were made in the plumes from six volcanoes, several prescribed burns of forest debris and several coal-fired electric power plants. The effects of the emissions from a coal-fired power plant on cloud microstructures in the vicinity of the plant were also investigated. Large variations were observed in the type, size and quantity of particles emitted from volcanoes. Emissions from forest fires exhibited relatively uniform particle size distributions. Forest fires were found to be substantial sources of ozone and cloud condensation nuclei. The effluents from a large coal-fired power plant were found to have little significant effects on the microstructure of cumulus clouds. However, the emissions increased the number of droplets in a stratus cloud by almost an order of magnitude in the portion of the cloud that mixed with the plume. Dissert. Abstr.

N79-29713 Rhode Island Univ., Kingston.
LATE NEOGENE AND QUATERNARY PALEOCEANOGRAPHY AND BIOSTRATIGRAPHY OF THE GULF OF MEXICO Ph.D. Thesis
Charlotte A. Brunner 1978 356 p
Avail: Univ. Microfilms Order No. 7915452

A series of studies of planktonic foraminifera in marine sections from the Gulf of Mexico have been used to examine the paleoceanography of the region during the Late Neogene and Quaternary. Recent distributions of planktonic foraminifera were examined from 140 trigger core-tops from the Gulf of Mexico. Q-Mode factor analysis was used to extract five factors from 23 species of the Gulf of Mexico and the Atlantic Ocean. Distributions of factor loadings mark known oceanographic features and clearly define five naturally occurring assemblages. Four regression equations were written that estimate summer and winter temperatures and salinities of surface waters from the five planktonic formaminiferal assemblages defined by factor analysis. Dissert. Abstr.

N79-29714 Stanford Univ., Calif.
A MATHEMATICAL MODEL OF LANDFORM DEVELOPMENT IN THE CANYONLANDS REGION OF SOUTHEASTERN UTAH Ph.D. Thesis
Norma Luanne Vanderpool 1979 166 p
Avail: Univ. Microfilms Order No. 7917287

The significant erosional processes observed on the Colorado Plateau in an area surrounding Deadhorse Point, about 20 miles southwest of Moab, Utah were incorporated into a three-dimensional FORTRAN program (ERODE) which simulates the geological effects of these processes through progressive time steps. Process interactions investigated over a relatively short span of elapsed time showed that the amount and location of talus was critical to the stability of the system. Changes in the form and shape of the landscape with differing base levels were also investigated over a longer span of total simulated time. Few changes in the form of the land surface resulted during the approximately 40,000 years of simulated time which implies the presence of dynamic equilibrium in the simulated drainage basin. Changing base level conditions resulted in localized changes in the development of the landscape. A drop in base level resulted in increased degradation and localized stream incision. A rise in base level resulted in decreased erosion. Dissert. Abstr.

N79-29715 Rhode Island Univ., Kingston.
GEOPHYSICAL INVESTIGATION OF THE STRUCTURAL FRAMEWORK OF THE SOUTHERN PORTION OF THE CARBONIFEROUS NARRAGANSETT BASIN, RHODE ISLAND Ph.D. Thesis
Barclay Powers Collins 1978 182 p
Avail: Univ. Microfilms Order No. 7915453

Geophysical results and geological data from the southern portion of the Narragansett basin define three inferred fault systems trending NW-SE, NNE-SSW, and NE-SW. All three conjectured fault trends, also evident within the surrounding southern New England region, may be older zones of weakness related to an early Paleozoic episode of deformation. These geophysical, structural, and temporal similarities between the southern portion of the Narragasett basin and the Fundy rift system to the north indicate these basins were part of a continuous rift system created in Late Devonian to Permian time by differential motion between North America and Africa-Europe. The rift zone is presently defined in northern Newfoundland and Nova Scotia; through Gulf of Maine, Massachusetts, and Rhode Island; and extends offshore for an undetermined distance. Dissert. Abstr.

N79-29716 Stanford Univ., Calif.
EVALUATION OF INTERMEDIATE-PERIOD SEISMIC WAVES AS A GEOTHERMAL EXPLORATION TOOL Ph.D. Thesis
Robert George Daniel 1979 143 p
Avail: Univ. Microfilms Order No. 7917220

The usefulness of 1 to 30 sec seismic waves in locating sources of geothermal energy in the crust and upper mantle was investigated using a portable, rugged, field recording system to measure teleseismic shear wave travel time delays and surface wave phase velocities on the site of a powerful crustal heat source, Yellowstone caldera, Wyoming. Seismic data obtained and previous U.S.G.S. experiments in the Yellowstone area were combined to yield a model for seismic velocities and Poisson's ratio beneath the caldera. The low shear velocities and high Poisson's ratio below approximately 4.5 km depth are strong evidence for the presence of a partial melt zone penetrating the entire crustal thickness; volume and anomalous heat content of this body are estimated at 1.5 x 10 to the 10th power cu km and 4.5 x 10 to the 22nd power cal. Dissert. Abstr.

N79-29717 Washington Univ., Seattle.
SIMULTANEOUS INVERSION OF SEISMIC TRAVEL-TIMES AND AMPLITUDES Ph.D. Thesis
William Edward Snydsman 1979 112 p
Avail: Univ. Microfilms Order No. 7917639

A technique is presented for using travel-time and amplitude information simultaneously to predict oceanic crustal velocity models. The method uses generalized inverse theory and geometric ray tracing techniques to find perturbations to a starting model which minimize the errors in the data estimates. Test models investigate the effects that various model parameters have on the inversion results. Results obtained using the travel-time and amplitude information simultaneously show that use of amplitude information increases the accuracy and resolution of the model estimates in the upper crustal region. Inversion of an actual seismic refraction line was performed and results were compared to previous synthetic seismogram interpretations of the same data. Dissert. Abstr.

N79-29718 Arizona Univ., Tucson.
VOLCANO-ICE INTERACTIONS ON THE EARTH AND MARS Ph.D. Thesis
Carlton Carl Allen 1979 145 p
Avail: Univ. Microfilms Order No. 7917333

The interaction of volcanism with ice and water produces a suite of landforms with morphologies highly characteristic of their origin. They include large flood channels, distinctive mountains and ridge systems, and fields of steam explosion craters. Features similar to these in form, size and geologic setting occur on Mars and prove to be valuable indicators of the history of water on that planet. Dissert. Abstr.

N79-29719 Florida State Univ., Tallahassee.
ENERGETICS OF LONG WAVES IN THE TROPICS DURING THE SUMMER OF 1974 Ph.D. Thesis
Colin Arthur Depradine 1978 226 p
Avail: Univ. Microfilms Order No. 7917034

This data set allows a resonably good delineation of the tropical motion field at three levels 200 mb, 250 mb, and

300 mb. An iterative procedure used to initialize a Florida State University multilevel primitive equation prediction model is used to obtain geopotential fields. These fields in turn provide a temperature field at 250 mb. The kinematic method is used to obtain vertical motion fields. Using these data the conversion of available potential energy to kinetic energy in the wavenumber domain at 250 mb is calculated. Dissert. Abstr.

N79-29720*# Pennsylvania State Univ., University Park. Ionosphere Research Lab.
IONOSPHERIC RESEARCH Semiannual Status Report, 1 Oct. 1978 - 31 Mar. 1979
1979 43 p refs
(Contract N00014-77-C-0041; Grants NGL-39-009-003; NGR-39-009-032; NsG-6004; NsG-5212; NSF ATM-76-03144-A01; NSF ATM-76-14277-A01; NSF ATM-78-19964; NSF ATM-76-81004-A01; NSF ATM-78-16832)
(NASA-CR-158759; PSU-IRL-SAR-79/1; SASR-1) Avail: NTIS HC A03/MF A01 CSCL 04A

Research projects in progress are reported. These include: planetary atmospheres, E- and F-region, and D-region. F.O.S.

N79-29721# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
CONFINEMENT OF EQUATORIAL COUNTER ELECTROJETS TO RESTRICTED LONGITUDES
R. P. Kane and N. B. Trivedi Dec. 1978 14 p refs
(INPE-1409-PE/188) Avail: NTIS HC A02/MF A01

The variations of the H component of geomagnetic field at Ribeirao (49 deg W) at dip equator in Brazil were compared with those at Huancayo (75 deg W) also near dip equator. Considerable differences were noticed. In particular, substantial counter electrojets were observed exclusively at Ribeirao, indicating that the phenomenon of counter electrojets can remain confined to very restricted longitude zones. R.E.S.

N79-29722*# System Planning Corp., Arlington, Va.
POLAR ENVIRONMENTAL MONITORING Final Report
Robert G. Nagler and Andreas C. Schulteis Feb. 1979 95 p refs Sponsored by NASA Prepared for JPL
(Contract JPL-955068)
(NASA-CR-158866; SPC-392) Avail: NTIS HC A05/MF A01 CSCL 08F

The present and projected benefits of the polar regions were reviewed and then translated into information needs in order to support the array of polar activities anticipated. These needs included measurement sensitivities for polar environmental data (ice/snow, atmosphere, and ocean data for integrated support) and the processing and delivery requirements which determine the effectiveness of environmental services. An assessment was made of how well electromagnetic signals can be converted into polar environmental information. The array of sensor developments in process or proposed were also evaluated as to the spectral diversity, aperture sizes, and swathing capabilities available to provide these measurements from spacecraft, aircraft, or in situ platforms. Global coverage and local coverage densification options were studied in terms of alternative spacecraft trajectories and aircraft flight paths. R.E.S.

N79-29723*# National Aeronautics and Space Administration, Washington, D. C.
ON THE ACCELERATION OF THE AURORAL PLASMA OF THE EARTH DUE TO CONIC INSTABILITY
R. S. Churayev Jun. 1979 19 p refs Transl. into ENGLISH of "Ob Uskorenii Avroralnoy Plazmy Zemli Vsledstviye Konusnoy Neustoychivosti", Rept. Pr-430 Acad. of Sci. USSR, Inst. of Space Res., Moscow, 1978 p 1-19 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-75638; Pr-430) Avail: NTIS HC A02/MF A01 CSCL 04A

The role of electrostatic conic instability in the diffusion of spilled particles and the acceleration of the auroral plasma of the Earth are numerically investigated by means of quasi-linear equations. Linear increments to the conic instability under magnetospheric conditions are introduced. The quasi-linear equation is averaged along tubes of force taking into account the drift across the magnetic field lines. It is shown that the existence of a conic instability leads to small spills and isotropic distribution of particles, but is also accompanied by significant acceleration of electrons. J.M.S.

N79-29724*# National Aeronautics and Space Administration, Washington, D. C.
STUDY OF THE 10 MICRON CONTINUUM OF WATER VAPOR
V. N. Arefyev, V. I. Dianov-Klokov, V. M. Ivanov, and N. I. Sizov Jul. 1979 36 p refs Transl. into ENGLISH of "Issledovaniya 10 mkm Kontinuuma Vodyanogo Para" USSR Acad. of Sci., Inst. of Expti. Meteorol., Moscow, 1979 p 1-38 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-75650) Avail: NTIS HC A03/MF A01 CSCL 04A

Radiation attenuation by atmospheric water vapor is considered. A formula based on laboratory data is recommended for approximating continuous absorption in the spectra region in question. Data of full scale measurements and laboratory experiments are compared. It was concluded that only molecular absorption need be taken into account under clear atmospheric conditions during the warm part of the year, while in winter or in cloudy conditions, the effect of aerosol can be significant. M.M.M.

N79-29725*# National Aeronautics and Space Administration, Washington, D. C.
ON THE POSSIBILITY OF ANALYTICAL APPROXIMATION OF LINE FORMS DURING RANDOM DISORDERS OF THE RESONANCE FREQUENCIES IN MOLECULAR VIBRATION-ROTATION SPECTRA FOR SATELLITE SOUNDING
V. V. Fomin Jul. 1979 71 p refs Transl. into ENGLISH of "O Vozmozhnosti Analiticheskoy Approksimatsii Formy Liniy pri Proizvolnykh Rasstroykakh Rezonansnykh Chastot v Kolebatelno-vrashchatelnykh Spektrakh Molekul dlya Tseley Sputnikovogo Zondirovaniya" Inst. of the Optics of the Atmosphere, Siberian Section, USSR Acad. of Sci., Tomsk, 1978 p 1-67 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-75655) Avail: NTIS HC A04/MF A01 CSCL 04A

The generalization spectral line contour concept and formulas for a two component mixture, as well as consequences of the general formula are discussed. The calculation procedure, initial information, calculation results and comparison of calculations with available experimental data, for radiation absorption in three CO2 bands are presented. Author

N79-29726*# City Coll. of the City Univ. of New York.
SPHERICAL HARMONIC ANALYSIS FOR VERFICATION OF A GLOBAL ATMOSPHERIC MODEL
Zaphiris Christidis and Jerome Spar Aug. 1979 9 p refs
(Grant NGR-33-013-086)
(NASA-CR-158867) Avail: NTIS HC A02/MF A01 CSCL 04A

Surface spherical harmonics were used to analyze the horizontal fields of various quantities generated by a global climate model. Also, the computed monthly mean forecast fields were compared with the corresponding observed fields. R.E.S.

N79-29727*# Wisconsin Univ., Madison. Space Science and Engineering Center.
AN INVESTIGATION OF SURFACE ALBEDO VARIATIONS DURING THE RECENT SAHEL DROUGHT Final Report
Carl C. Norton, Frederick R. Mosher, and Barry Hinton [1978] 58 p refs
(Grant NGR-50-002-215)
(NASA-CR-157448) Avail: NTIS HC A04/MF A01 CSCL 04A

Applications Technology Satellite 3 green sensor data were used to measure surface reflectance variations in the Sahara/Sahel during the recent drought period; 1967 to 1974. The magnitude of the seasonal reflectance change is shown to be as much as 80% for years of normal precipitation and less than 50% for drought years. Year to year comparisons during both wet and dry seasons reveal the existence of a surface reflectance cycle

coincident with the drought intensity. The relationship between the green reflectance and solar albedo is examined and estimated to be about 0.6 times the reflectance change observed by the green channel. Author

N79-29728# Geological Survey, Washington, D. C.
GENERAL GEOLOGY, PETROLEUM APPRAISAL, AND NATURE OF ENVIRONMENTAL HAZARDS EASTERN PACIFIC SHELF LATITUDE 28 DEG TO 38 DEG NORTH
D. G. Howell, D. S. McCulloch, and J. G. Vedder 1978 33 p refs
(Circ-786) Avail: NTIS HC A03/MF A01

Additional petroleum exploration is anticipated within the Federal waters of the California offshore region. To assist in evaluating the impact of petroleum exploration and development, the geology and environmental setting of the Outer Continental Shelf are reviewed for the region from the latitude of San Francisco Bay (38 degrees N.) to the approximate latitude of Cedros Island (28 degrees N.), Baja California, Mexico. Author

N79-29729# Geophysical Observatory, Sodankyla (Finland).
EXAMPLES OF THE INFLUENCE OF AURORAL ZONE ELECTRIC FIELDS ON THE EQUATORIAL IONOSPHERIC F-LAYER DURING EXTREMELY STRONG MAGNETIC STORMS
Tauno Turunen and M. Mukunda Rao (Indian Inst. of Tech., Madras) Jun. 1979 17 p
(Rept-33) Avail: NTIS HC A02/MF A01

The behavior of the F-layer critical frequency (foF2) above Huancayo between 10 and 14 local time was studied. Seven anomalous decreases of foF2 roughly simultaneous with some of the maxima in the AE index were observed. In each case, a magnetic storm commenced a few hours earlier and exceeded, at least occasionally, the 1000 gamma level in the AE index. A possible explanation for the phenomenon is that the electric field related to the Birkeland current system in the auroral zone extends to the equator and temporarily enhances the equatorial anomaly in the F-layer K.L.

N79-29730*# National Aeronautics and Space Administration, Washington, D. C.
METHOD FOR THE RAPID TEMPERATURE CORRECTION OF A TRANSMISSION IN AN INHOMOGENEOUS ATMOSPHERE
V. A. Varnava, A. B. Karasev, V. V. Sapunov, and O. B. Fedichev Jul. 1979 8 p Transl. into ENGLISH of "Metodika Bystroy Korrektsii po Temperature Propuskaniya Neodnorodnoy Atmosfery", Rept. from Acad. of Sci. USSR, Moscow, 1979 p 1-6 Presented at 3d Conf. of the Soviet-Am. Working Group on Space Meteorol., Moscow, 10-22 Nov. 1976 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-75649) Avail: NTIS HC A02/MF A01 CSCL 04A

The value of the transmission function in a heterogeneous atmosphere is determined by iterative correction of values in particular layers. The iterative equation and a set of absolute values of errors is presented in two tables. Author

N79-29731*# National Aeronautics and Space Administration, Washington, D. C.
THE EFFECT OF ERRORS IN THE ASSIGNMENT OF THE TRANSMISSION FUNCTIONS ON THE ACCURACY OF THE THERMAL SOUNDING OF THE ATMOSPHERE
Yu. M. Timofeyev Jul. 1979 18 p refs Transl. into ENGLISH of "Vliyaniye Oshibok v Zadanii Funktsiy Propuskaniya na Tochnost Termicheskogo Zondirovaniya Atmosfery", Rept. from Acad. of Sci. USSR, Moscow, 1979 p 1-13 Presented at 3d Conf. of the Soviet-Am. Working Group on Space Meteorol., Moscow, 10-22 Nov. 1976 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-75654) Avail: NTIS HC A02/MF A01 CSCL 04A

In order to test the error of calculation in assumed values of the transmission function for Soviet and American radiometers sounding the atmosphere thermally from orbiting satellites, the assumptions of the transmission calculation is varied with respect to atmospheric CO2 content, transmission frequency, and atmospheric absorption. The error arising from variations of the assumptions from the standard basic model is calculated.A.W.H.

N79-29732# Institute for Defense Analyses, Arlington, Va. Science and Technology Div.
INFRARED ATTENUATION BY AEROSOLS IN LIMITED ATMOSPHERIC VISIBILITY: RELATIONSHIP TO LIQUID WATER CONTENT Final Report
Robert E. Roberts and Lynne N. Seekamp Mar. 1979 19 p refs
(Contract DAHC15-73-C-0200)
(AD-A068503; AD-E500063; IDA-P-1394; IDA/HQ-78-20939) Avail: NTIS HC A02/MF A01 CSCL 20/6

A simple relationship between infrared attenuation in the 8-12 micrometers region and liquid water content of the atmosphere is derived by using a straightforward moment analysis. A variety of experimental and theoretical data is used to demonstrate the validity of this relationship under limited visibility conditions. GRA

N79-29733# Army Construction Engineering Research Lab., Champaign, Ill.
DEVELOPMENT AND USE OF SEISMIC SHOCK TEST CRITERIA FOR ESSENTIAL EQUIPMENT IN CRITICAL FACILITIES Final Report
P. N. Sonnenburg and J. D. Prendergast Apr. 1979 100 p refs
(DA Proj. 4A7-62731-AT-41-04)
(AD-A068295; CERL-TR-M-236) Avail: NTIS HC A05/MF A01 CSCL 14/2

This report provides procedures for establishing seismic qualification test criteria for essential equipment in critical facilities and presents guidance for interpretation of the test results. Since equipment representative of that used in the essential systems of critical facilities was observed to be closely related to many items of tactical support equipment used at missile sites, existing data from proof and fragility tests on tactical support equipment were reviewed to analyze failure characteristics. The failure data were organized so they could be statistically analyzed to provide estimates of the probability of failure. The major tasks in the seismic test qualification of equipment are summarized; these tasks include test criteria formulation, test facility selection, test unit formulation, establishment of test qualification requirements, and interpretation of test results. Test criteria were developed by: (1) test axis selection, (2) statement of operating configuration, (3) definition of expected failure modes, and (4) description of the shock environment which can be transformed into a time history waveform to drive a shake table. Methods for developing waveform test criteria from the output of various types of dynamic building analyses are presented. Requirements for reporting and documenting test results are also discussed. GRA

N79-29734# Naval Research Lab., Washington, D. C.
AEROSOL PARTICLE SIZE MEASUREMENTS AT SAN NICOLAS ISLAND DURING CEWCOM-78
Richard K. Jeck 9 Mar. 1979 66 p refs
(WF32344012)
(AD-A068329; NRL-MR-3931) Avail: NTIS HC A04/MF A01 CSCL 04/2

Particulate aerosol size spectra obtained during the CEWCOM-78 exercise (8-22 May 1978) at San Nicolas Island, California, are presented for the particle size range 0.745 micrometers diameter as measured with a PMS Axially Scattering Spectrometer Probe. In addition, an informal account of the daily meteorological and visibility conditions as observed visually from several vantage points on the island is given to help in the interpretation of the aerosol and optical data collected during the measurement session. These observations point out: (1) the need for slant path optical transmission measurements due to the generally strong, vertical gradient in visibility in the lowest 300m or so above sea level, (2) the general susceptibility of Sites A and D to surf-generated aerosols and the additional susceptibility to dust for winds above 10m/sec, (3) the suitability of the upper two levels of the NRL tower for representative aerosol measurements except possibly during near calm wind conditions, (4) the suitability of SNI as a site for obtaining optical transmission measurements in mari-

time clouds, and (5) the existence of a newly observed phenomenon in which the downward vortex of air behind large, breaking or cresting waves in high wind situations prevents much of the crest-generated spray from becoming airborne. This mechanism may help explain the recently reported cases where the particle concentrations are lower and the visibilities are better in high wind situations than is to be expected from aerosol models where particle number densities increase indefinitely with wind speed. GRA

N79-29735# Naval Research Lab., Washington, D. C.
MEASUREMENTS OF ATMOSPHERIC 222Rn AT SAN NICOLAS ISLAND AND OVER NEARBY CALIFORNIA COASTAL AREAS DURING CEWCOM-78
R. E. Larson, W. Kasemir, and D. J. Bressan 14 Mar. 1979 15 p refs
(WF32344012)
(AD-A068330; NRL-MR-3941) Avail: NTIS HC A02/MF A01 CSCL 04/1

Shipboard and island measurements show that clean maritime air prevailed over San Nicolas Island, California, for two periods of a day or more each during the twelve days of data collection and moderately continental air prevailed for the remainder of the time. Moderately continental air was encountered out to 200km from shore on 8 and 9 May on a dogleg course from Monterey to the San Nicolas Island area. Maritime air was encountered throughout the direct return trip along the coast, showing that the relative continental/maritime nature of the air at a given location in the area is more dependent upon prevailing winds than on distance from land. Radon measurements at the NRL tower site on San Nicolas Island were in good agreement with shipboard data throughout the area, suggesting a relatively uniform distribution of air over a large area, whether it be maritime or moderately continental. The moderately continental conditions prevailing at San Nicolas Island are not unlike those previously encountered for one or more days in remote Pacific areas in air of Asian origin. GRA

N79-29736# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
CHARGED PARTICLE ACCELERATION IN INNER MAGNETOSPHERE Final Report
W. P. Olson, K. A. Pfitzer, and G. J. Mroz Mar. 1979 57 p refs
(Contract N00014-78-C-0215)
(AD-A068183) Avail: NTIS HC A04/MF A01 CSCL 04/1

A quantitative model of the disturbed magnetospheric magnetic field has been developed. In it the fields produced by each of the three major magnetospheric current systems (magnetopause, ring, and tail) have been represented separately. This is necessary since during magnetically active periods the strengths and topology of these currents change. A template of a magnetic storm was developed in order to represent the associated time varying magnetic field. The magnetic vector potential was also represented. A knowledge of its time history can be used to determine the associated induced electric field. GRA

N79-29737# Army Communications Research and Development Command, Fort Monmouth, N. J.
RUNNING AN IONOSPHERIC RAY TRACING PROGRAM ON THE PDP-11/40 MINI-COMPUTER: INSTRUCTION BOOK
Abraham Shuval and Francis J. Gorman Apr. 1979 124 p refs
(AD-A068367; CORADCOM-79-1) Avail: NTIS HC A06/MF A01 CSCL 04/1

Locating the source of transmission is one of the tasks of military intelligence. In VHF frequencies and above, the technique is straight forward. In HF (2-30 MHz), the situation is different since the main mode of propagation is by reflection from the ionosphere. This enables the use of a different technique where the azimuth and elevation of the incoming wave are measured together with the state of the ionosphere at the time of reception. All this information is presented as an input to an ionospheric ray tracing program that calculates the ray's trajectory from the reception site to the transmitting point. The actual system needed is quite complicated and elaborate. Apart from the equipment to measure the direction of the arrival of the incoming wave, there is a requirement to measure in real-time the structure of the ionosphere at the area of interest. It is required, therefore, to measure the electron density profile and the tilts of the ionospheric layers. This can be accomplished by using a Digisonde together with a special 'Drift Attachment' equipment that can measure ionospheric tilts by Doppler techniques. This report is essentially an instruction book that shows how to run the ray tracing program on the PDP-11/40. The first part describes generally how to write into the machine, edit, debug, and run a FORTRAN program. The second part depicts the operation of the ray tracing program itself. GRA

N79-29738# Drexel Univ., Philadelphia, Pa. Dept. of Physics and Atmospheric Sciences.
LASER RADAR MEASUREMENT OF ATMOSPHERIC TEMPERATURE PROFILES Final Report, 1 Apr. 1975 - 31 Dec. 1978
John A. Cooney May 1979 9 p refs
(Grant DAAG29-75-G-0101)
(AD-A069400; ARO-12835.3.GS) Avail: NTIS HC A02/MF A01 CSCL 04/2

A laser radar was implemented as a Raman lidar by redesigning two channels into the receiver. Thus two filters permitted two different portions of the Raman rotational spectrum of the air mix of N2 and O2 to be monitored. A ratio of these two intensities is a unique function of the temperature. Measurements by laser radar reproduced temperature profiles with an average absolute difference of + or - 1.0 K at altitudes up to 2.3 km as compared with radiosonde profiles. GRA

N79-29739# New Mexico State Univ., Las Cruces. Dept. of Physics.
STUDIES ON THE DEVELOPMENT OF ALGORITHMS FOR THE PREDICTION OF TIME-DEPENDENT OPTICAL PROPERTIES OF AEROSOLS Final Report
August Miller, George H. Goedecke, Richard C. Shirkey, and Yugal K. Behl Dec. 1978 157 p refs
(Contract DAAD07-78-C-0063)
(AD-A069449; NMSU-PHYS-586-78-1) Avail: NTIS HC A08/MF A01 CSCL 04/1

Most of the work done under the contract has been directed toward searches for ways in which existing aerosol IR transmit- computationally more efficient in order to enhance their utility in applications involving time dependent variations in aerosol properties. In the course of those studies, NMSU personnel have examined both rigorous and approximate methods for calculating both single and multiple scattering extinction and scattering effects, and have devised a new version of the NMSU/ASL code AGAUS which permits the user to trade-off overall accuracy for significantly faster program execution. The latter code has also been modified in such a way that it can be easily used for generating data which can be used directly by the Smoke Obscuration Model. A serious effort has also been made to generate improved documentation for program AGAUS. The new documentation will probably also enhance the general utility of the code. Author (GRA)

N79-29740# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
ESTIMATION OF THE ANOMALOUS GRAVITY GRADIENT VIA PRECISION ANGLE TRACKING M.S. Thesis
Richard Wayne Smart Dec. 1978 97 p refs
(AD-A069209; AFIT/GGC/EE/79-3) Avail: NTIS HC A05/MF A01 CSCL 17/7

A preliminary feasibility study was done on a proposal to estimate the anomalous gravity gradient via precision measurements between two accelerometer triads moving through a gravity field. The state equations to describe the system were developed and an Extended Kalman Filter was designed to exploit the measurement data. A simple, first-order numerical approximation was used in gradient estimation. In addition, a brief conceptualization of the hardware which might be used in an operational system of this type is included. The results indicate that the numerical ill-conditioning in the problem makes the Extended Kalman Filter a poor choice of estimator. Even after scaling variables and employing a U-D Covariance factorization update algorithm, numerical instabilities in the filter were observed.

Recommendations for further work on this topic are included.
Author (GRA)

N79-29741# Air Force Geophysics Lab., Hanscom AFB, Mass.
SATELLITE DENSITY MEASUREMENTS WITH THE ROTATABLE CALIBRATION ACCELEROMETER (ROCA)
F. A. Marcos and K. S. W. Champion 4 Jan. 1979 22 p refs
(AF Proj. 6690)
(AD-A069740; AFGL-TR-79-0005; AFGL-IP-274) Avail: NTIS HC A02/MF A01 CSCL 04/1

Satellite accelerometer measurements of atmospheric density have provided significant improvement in our understanding of the structure and dynamics of the lower thermosphere. Derivation of accurate data with this technique requires removal of instrument bias from the total sensor output. The ROCA (Rotatable Calibration Accelerometer) experiment was flown to provide and orbital calibration capability on the three-axis stabilized S3-4 satellite. The ROCA sensitive axis could be operated in either of two orientations selectable by ground command. For density measurement (normal operating mode) the sensitive axis was aligned with the satellite velocity vector. For direct measurement of bias, the sensitive axis was aligned perpendicular to the velocity vector. Utilization of the inflight calibration technique showed a dependence of the bias upon the instrument operating temperature. Removal of the bias-temperature component from the total acceleration signal obtained in the normal operating mode permits derivation of accurate density data. Measurements of atmospheric density were obtained during approximately 600 orbits over a five month period. The resulting ROCA data will be utilized for improved satellite ephemeris computations and for detailed studies of the lower thermosphere, particularly those related to energy inputs at high latitudes. GRA

N79-29742# Air Force Geophysics Lab., Hanscom AFB, Mass.
ESTIMATES OF VERTICAL EDDY DIFFUSION DUE TO TURBULENT LAYERS IN THE STRATOSPHERE
Edmond M. Dewan 1 Feb. 1979 31 p refs
(AF Proj. 6687)
(AD-A069750; AFGL-TR-79-0042; AFGL-ERP-656) Avail: NTIS HC A03/MF A01 CSCL 04/1

Vertical transport in the stratosphere occurs by many processes and the question of the relative importance of stratified turbulence is considered in the context of a 'vertical stack model' described in a previous report. The 'vertical stack model' was designed to estimate the effect of intermittent turbulent layers (separated by essentially laminar flow) and it is here examined in some detail. In particular, a number of less obvious implications are discussed and a list of experimental tests of the model is suggested. It is concluded that the rate of turbulence for vertical transport in the stratosphere remains an open question. GRA

N79-29743# Atomics International, Canoga Park, Calif.
DETERMINISTIC INSOLATION MODEL PROGRAM DESCRIPTION AND USER'S GUIDE
E. P. French Jul. 1978 53 p refs
(Contract EY-76-C-04-0789)
(SAND-78-7044) Avail: NTIS HC A04/MF A01

A simple mathematical model is described for estimating the monthly average insolation experienced by a fixed or tracking collector. It is designed to fulfill the need for a rapid, economical method of assessing the availability of solar radiation as a basis for site selection and system performance estimation. It attempts to make maximum use of predictable factors, introducing random factors associated with local weather in the simplest way possible. The method lends itself to a formulation in terms of simple mathematical expressions and is suitable for use by hand calculators and small computers. DOE

N79-29744# Danish Meteorological Inst., Copenhagen. Ionosphere Lab.
RIOMETER ABSORPTION DATA: 1 OCTOBER - 31 DECEMBER 1977, GODHAVEN, NARSSARSSUAQ, TJOERNES, TROMSOE
Peter Stauning 17 Apr. 1978 32 p
(DMI-IONLAB-R-47) Avail: NTIS HC A03/MF A01

Absorption data from riometers operating in Greenland, Iceland, and Norway from October 1 to December 31, 1977 are presented. Riometers at the mentioned observatories are part of the Ionlab polar riometer net comprised of 27 riometers at 16 stations (Dec. 1977). Geograoghic and geomagnetic coordinates, 100 Km L values, and riometer frequencies are given for each observatory. Equipment, data quality, and data processing are discussed. Author (ESA)

N79-29745# Danish Meteorological Inst., Copenhagen. Ionosphere Lab.
RIOMETER ABSORPTION DATA: 1 JANUARY - 31 MARCH 1978, GODHAVEN, NARSSARSSUAQ, TJOERNES, TROMSOE
Peter Stauning 30 May 1978 32 p
(DMI-IONLAB-R-48) Avail: NTIS HC A03/MF A01

Absorption data from riometers operating in Greenland, Ireland, and Norway are presented. These Riometers are part of the Ionlab polar riometer not comprised of 27 riometers at 16 stations (Dec. 1977). Geographic and geomagnetic coordinates, 100 Km L values, and riometer frequencies are given for each observatory. Equipment, data quality, and data processing are discussed. Author (ESA)

N79-29746# Danish Meteorological Inst., Copenhagen. Ionosphere Lab.
POLAR RIOMETER ABSORPTION DATA: 1 JULY 31 DECEMBER 1976.
Peter Stauning and Bjarne Christensen Sep. 1978 58 p
(DMI-IONLAB-R-49) Avail: NTIS HC A04/MF A01

Riometer observations of cosmic noise absorption in the polar ionosphere during the period: 1 July - 31 December 1976 are summarized. The data are obtained from riometers at a network of observatories in Greenland, Faroe Islands, and North Norway. Geographic and geomagnetic coordinates of the observatories are given. Equipment, data quality, and data processing are discussed. J.M.S.

N79-29747# Danish Meteorological Inst., Copenhagen. Ionosphere Lab.
RIOMETER ABSORPTION DATA: 1 APRIL - 30 JUNE 1978, GODHAVEN, NARSSARSSUAQ, TJOERNES, NY-AALESUND, TROMSOE
Peter Stauning 18 Oct. 1978 34 p
(DMI-IONLAB-R-50) Avail: NTIS HC A03/MF A01

Absorption data from riometers operating in Greenland, Iceland, and Norway are presented. These are part of the Ionlab polar riometer network which includes 27 riometers at 16 stations. Geographic and geomagnetic coordinates of the observatories are given. Equipment, data quality, and data processing are discussed. Author (ESA)

N79-29748# Danish Meteorological Inst., Copenhagen. Ionosphere Lab.
COMPILATION OF IONLAB RIOMETER DATA FOR IMS WORKSHOP IN BAD LAUTERBERG
Peter Stauning Oct. 1978 25 p
(DMI-IONLAB-R-51) Avail: NTIS HC A02/MF A01

Absorption data obtained from Ionlab riometers located throughout a network of observatories in Greenland, Iceland, the Faroe Islands, and Norway are presented. The diagrams refer to absorption intensities from two selected periods: 2-3 December 1977, 2-3 March 1978. The latter period includes the auroral break-up compaign for the event starting 22:22 UT on March 2d. Observatory locations, equipment, data quality, and data processing are described. Author (ESA)

N79-29749# Danish Meteorological Inst., Copenhagen. Ionosphere Lab.
RIOMETER ABSORPTION DATA: 1 JULY - 30 SEPTEMBER 1978, GODHAVEN, NARSSARSSUAQ, DANEBORD, TJOERNES, NY-AALESUND, BJOERNOEYA OG TROMSOE
Peter Stauning Nov. 1978 34 p
(DMI-IONLAB-R-52) Avail: NTIS HC A03/MF A01

Absorption data from riometers operating in Greenland, Iceland, and Norway are presented. These riometers are part of the Ionlab polar net which includes 27 riometers at 16 stations (Dec. 1977). Geographic and geomagnetic coordinates of the observatories are given. Equipment data quality and data processing are discussed. Author (ESA)

N79-29750# Danish Meteorological Inst., Copenhagen. Ionosphere Lab.
COMPILATION OF IONLAB RIOMETER DATA FOR THE PERIOD 10-14 AUGUST 1978
Peter Stauning 15 Nov. 1978 27 p
(DMI-IONLAB-R-53) Avail: NTIS HC A03/MF A01

Absorption data obtained from the Ionlab polar region riometer network are presented. During this period a number of balloon and other space experiments were conducted to study energetic particle precipitation into the auroral zone and polar cap atmospheres. Energetic particle precipitation is responsible for most of the absorption events shown in the diagrams. The auroral and polar event as observed by the riometer net were relatively weak and featureless. Location of the observatories as well as equipment and data processing facilities are described.
Author (ESA)

N79-29751# Institute of Geological Sciences, Edinburgh (Scotland).
MAGNETIC RESULTS, 1972: ESKDALEMUIR, HARTLAND AND LERWICK
1978 118 p
(ISBN-0-11-884087-8) Avail: NTIS HC A06/MF A01

Magnetic data (hourly, monthly) obtained in 1972 from three observations (Eskdalemuir, Hartland, and Lerwick) are presented in tabular form. Mean annual results for the periods 1919 to 1972 (Eskdalemuir), 1925 to 1956 (Abinger), 1957 to 1972 (Hartland), and 1923 to 1972 (Lerwick) are also given. The measurements relate to declinations (West), horizontal and vertical intensities, and diurnal inegalities of geomagnetic elements. K indices were obtained from combined D, H, and Z values. Observed and adopted baseline values for the three stations are presented. Corrections to 1971 magnetic data published in Bulletin 5 are given.
Author (ESA)

N79-29752# International Geophysical Year World Data Center A, Boulder, Colo.
GLACIOLOGICAL FIELD STATIONS, PART 1
Robert Vivian, comp. (Grenoble Univ.) Feb. 1979 110 p refs 2 Vol.
(PB-295290/1; NOAA-79040203-Pt-1; GD-4-Pt-1) Avail: NTIS HC A06/MF A01 CSCL 08L

A guide to facilities and organizations involved in field research relating to glaciers and ice caps is presented. A map of glaciological field stations and information on the glaciological field stations in Antarctica, Argentina, Austria, Canada, France, Greenland, Iceland, Japan, Kenya, Nepal, and New Zealand, is given. GRA

N79-29753# International Geophysical Year World Data Center A, Boulder, Colo.
GLACIOLOGICAL FIELD STATIONS, PART 2
Robert Vivian, comp. (Grenoble Univ.) Feb. 1979 131 p refs 2 Vol.
(PB-295291/9; NOAA-79040204-Pt-2; GD-4-Pt-2) Avail: NTIS HC A07/MF A01 CSCL 08L

Glaciological field stations located in Norway, Peru, Spitsbergen, Sweden, Switzerland, U.S., and U.S.S.R. are listed. A map of the glaciological field stations in these areas is included. GRA

N79-29754# National Oceanic and Atmospheric Administration, Ann Arbor, Mich. Great Lakes Environmental Research Lab.
ICE THICKNESS AND STRATIGRAPHY AT NEARSHORE LOCATIONS ON THE GREAT LAKES (ENGLISH UNITS)
Frederick E. Sleator Jul. 1978 442 p
(PB-295671/2; NOAA-DR-ERL-GLERL-1-1; NOAA-79041901) Avail: NTIS HC A19/MF A01 CSCL 08J

Ice-thickness and stratigraphic data were collected under a program instituted by the U.S. Lake Survey during winter 1965-66. The program is continuing under the Great Lakes Environmental Research Laboratory. The data collection network is documented and the data collection and editing procedures are described. Edited data are presented in Standard (English) units. GRA

47 METEOROLOGY AND CLIMATOLOGY

Includes weather forecasting and modification.

N79-29755 Washington Univ., Seattle.
THE INTERMITTENT STRUCTURE OF SURFACE-LAYER CONVECTION OVER THE TROPICAL OCEAN AND ITS SIGNIFICANCE IN THE PARAMETERIZATION OF TURBULENT FLUXES Ph.D. Thesis
Siri Jodha Singh Khalsa 1978 188 p
Avail: Univ. Microfilms Order No. 7917586

Convective elements were shown to be the cause of one type of intermittency and an investigation into their structure, properties and interactions was undertaken. Indirect flux measurements were used to investigate the short term behavior of the bulk aerodynamic flux parameterization scheme during both stationary and disturbed conditions. In approximately 50% of the data analyzed positive excursions in momentum flux were associated with minima in wind speed and vice versa. The effect was traced to the influence of plumes and shown to be stability dependent. The minimum averaging time necessary to smooth plume influence under different conditions is studied. The methods developed for comparison of stress estimates were applied in a case study involving an abrupt increase in wind speed.
Dissert. Abstr.

N79-29756 Washington Univ., Seattle.
THE OBSERVED STRUCTURE AND ENERGETICS OF TRANSIENT AND STATIONARY MOTIONS IN THE NORTHERN HEMISPHERE WINTERTIME CIRCULATION Ph.D. Thesis
Ngar-Cheung Lau 1978 194 p
Avail: Univ. Microfilms Order No. 7917592

The regional characteristics of midlatitude transient disturbances and their relationship with the stationary flow are studied by examining the three dimensional structure of atmospheric circulation statistics compiled from twice daily hemispheric analyses at 10 pressure levels (1000-100 mb) for 11 winters. The vertical structure and transport properties of transient eddies over the mid oceans resemble those associated with mature baroclinic waves. The disturbances over the western continents, which lie downstream of the centers of activity, acquire a more barotropic character, with prevalent destruction of kinetic energy induced by ageostrophic eddy motions in the upper troposphere. These longitudinal variations in the transient eddy statistics indicate that the synoptic disturbances are characterized by a well-defined life cycle.
Dissert. Abstr.

N79-29757 Washington Univ., Seattle.
MESOSCALE ORGANIZATION IN TROPICAL CLOUD CLUSTERS Ph.D. Thesis
Colleen Ann Leary 1978 235 p
Avail: Univ. Microfilms Order No. 7917593

Intense convection in tropical cloud clusters which moved over the observational network of the Global Atmospheric Research Program's Atlantic Tropical Experiment (GATE) during September 1974 was investigated using weather radar, rawinsonde, satellite, aircraft, and surface meteorological data. A detailed case study of the 5 September double cloud cluster demonstrates that nearly all of the precipitation associated with it fell in six mesoscale precipitation features. Five cloud clusters, the squall-line systems of 4-5 September, 11 September, 12 September, and 16 September, as well as the nonsquall cluster of 5 September are examined. Calculations which demonstrate the importance of mesoscale vertical velocities in intense tropical convection are presented.
Dissert. Abstr.

N79-29758 Michigan Univ., Ann Arbor.
NUMERICAL SIMULATIONS OF MESOSCALE PRECIPITATION SYSTEMS Ph.D. Thesis
Hsiao-ming Hsu 1979 370 p
Avail: Univ. Microfilms Order No. 7916730

A numerical model designed for the study of mesoscale weather phenomena is presented. It is a three-dimensional, time-dependent model based upon a mesoscale primitive-equation systems, and it includes parameterizations of cloud and

precipitation processes, boundary-layer transfer, and ground surface energy and moisture budgets. Two mesoscale weather phenomena under synopically undisturbed conditions are simulated for hypothetical situations derived from climatic data. They are: (1) sea-breeze convergence over the Florida Peninsula in summer; and (2) Lake-effect convergence over and in the lee of the Lake Michigan in late fall and early winter. Dissert. Abstr.

N79-29759 Maryland Univ., College Park.
DIAGNOSTIC STUDY OF TROPICAL CUMULUS INTENSITY USING A CELLULAR CONVECTION MODEL Ph.D. Thesis
Chi-Shung Cheng 1978 187 p
Avail: Univ. Microfilms Order No. 7917119

A simplified model for cumulus clouds was developed which incorporates many individual cloud characteristics under the control of the large scale environment. A study was then made of the model characteristics: (1) the entrainment hypothesis, (2) the choice of eddy diffusion coefficient, (3) the density variation with height, (4) the depth of outflow layer, (5) the drag force of liquid water, (6) the evaporative cooking in the downdraft region and (7) the control of large scale convergence on the cellular model clouds. Dissert. Abstr.

N79-29760# National Weather Service, Washington, D.C.
PROBABLE MAXIMUM PRECIPITATION ESTIMATES, UNITED STATES EAST OF THE 105TH MERIDIAN
Louis C. Schreiner and John T. Riedel Jun. 1978 93 p refs
(Rept-51) Avail: NTIS MF A01; SOD HC

The estimates are all-season estimates; that is, the greatest for any time of year, for drainages from 10 to 20,000 square miles (26 to 51,800 sq m) for durations of 6 to 72 hours. Details of the procedures and methods used for developing these estimates are described. Author

N79-29761# Environmental Data and Information Service, Washington, D. C.
SEA-SURFACE TEMPERATURE AND CLIMATE
Jun. 1979 12 p refs
(CIO-79-1) Avail: NTIS HC A02/MF A01

Interactions among the atmosphere, the oceans, and the earth's surface are considered along with factors that determine large-scale variations in sea surface temperature. Emphasis is placed on climatic variations associated with sea surface temperature anomalies and long range weather forecasting. J.M.S.

N79-29762# Raytheon Co., Waltham, Mass. Equipment Div.
LASER DOPPLER RADAR FOR REMOTE ATMOSPHERIC SOUNDING Final Report
Charles A. Dimarzio, Douglas W. Toomey, and Albert V. Jelalian Jan. 1979 40 p refs
(Contract N00014-75-V-0282)
(AD-A069092; ER79-4105) Avail: NTIS HC A03/MF A01 CSCL 04/2

Measurements have been made of the atmospheric velocity turbulence spectrum using a mobile, CO2, continuous wave, Doppler LIDAR system. The LIDAR was used in a heterodyne configuration with a 30 cm output optics to produce a conical scan. Velocity data from this scan were Fourier analyzed to obtain the velocity power density spectrum. The -5/3 power law of Kolmogorov was observed along with variations in total energy which could be correlated with storm activity. In addition, departures from the Kolmogorov spectrum were observed under some conditions. It is hoped that the total energy and departure from the -5/3 power law may prove useful in short-term meteorological forecasting. GRA

N79-29763# Army Tropic Test Center APO, Miami 34004.
METHODOLOGY INVESTIGATION TEMPERATURE FREQUENCY DISTRIBUTION DATA ASSOCIATED WITH STRUCTURES ON OPEN EXPOSURE IN THE HUMID TROPICS Technical Note, Sep. 1973 - Oct. 1977
W. H. Portig Nov. 1978 41 p refs
(AD-A068634; USATTC-781101) Avail: NTIS HC A03/MF A01 CSCL 08/6

The US Army Tropic Test Center performed a study of Temperature Frequency Distribution Data based on data collected in the Canal Zone from September 1973 to October 1977. Objective was to compile and analyze frequency distributions of surface and induced air temperatures of structures on open exposure in the humid tropics. Data were collected for a number of different structures located in open areas in both the wet and dry seasons and in different orientations for selected structures. The highest temperature mesured was 192 F (89 C) on the metallic ceiling surface of an insulated MILVAN container. The highest roof surface temperature was 180 F (82 C) occurring on a CONEX container, and the highest enclosed air temperature was 142 F (61 C) occurring within an empty, noninsulated MILVAN. A MILVAN positioned with its long axis running north to south had higher internal air temperatures than an identical MILVAN positioned with its long axis running east to west. The mean temperature difference was 5 F (3 C) at 0900 hours and 4 F (2 C) at 1530 hours. GRA

N79-29764# Canterbury Univ., Christchurch (New Zealand).
WIND CHARACTERISTICS OVER COMPLEX TERRAIN: LABORATORY SIMULATION AND FIELD MEASUREMENTS AT RAKAIA GORGE, NEW ZEALAND
Robert N. Meroney (Colo. State Univ.), Anthony J. Bowen, David Lindley, and John R. Pearse Auckland New Zealand Energy Res. and Develop. Comm. Oct. 1978 237 p refs
(NZERDC-P5; ISSN-0110-5388) Avail: NTIS HC A11/MF A01

Both terraced and contoured models of the Rakaia River Gorge region in New Zealand were prepared to an undistorted geometric scale of 1:5000. The contoured model was examined for three separate surface roughness conditions--a surface textured to represent typical paddock grass roughness only, the same surface with zero-porosity shelterbelts added, and the same surface with porous shelterbelts added. DOE

N79-29765# Royal Netherlands Meteorological Inst., De Bilt.
COMPUTER PROCESSING OF METEOROLOGICAL DATA [COMPUTER VERWERKING VAN METEOROLOGISCHE WAARNEMINGEN]
J. A. Geurts and A. M. J. Philippa Apr. 1978 81 p refs In DUTCH
(KNMI-V-299) Avail: NTIS HC A05/MF A01

The World Weather Watch Plan, the Global Observing System, the Global Data Processing System, and the Global Telecommunication System are briefly described. A detailed description follows of the data processing system which is intended to familiarize the potential user with the data handling capabilities of the system and with its data retrieval functions. Author (ESA)

N79-29766# Royal Netherlands Meteorological Inst., De Bilt.
RESULTS ON THE VERIFICATION OF FORECAST 500 mbar HEIGHTS USING MAXIMUM TEMPERATURE AS A VARIABLE [DOELGERICHTE VERIFIKATI VAN 500 mbar PROGNOSES AAN DE HAND VAN HIERUIT AFGELEIDE MAXIMUMTEMPERATUREN]
A. W. Hanssen 1978 23 p refs In DUTCH; ENGLISH summary
(KNMI-WR-78-3) Avail: NTIS HC A02/MF A01

The results of a comparison of KNMI-BK3 forecast charts and NMC-6PE forecast charts, both predicting maximum temperatures and using 500 mbar heights as a prediction criteria, are presented. Different forecast periods were used. The accuracy of the predictions was evaluated by a root-mean-square errors method. It was found that the mean error of predicted heights of the American forecast charts was considerably less than the mean error of the KNMI-BK3 forecast charts. Applying prognostic heights in order to forecast maximum temperatures resulted in a reduction of variance of about 25% for NMC-6PE forecast charts, where as KNMI-BK3 forecast charts gave no reduction at all. Author (ESA)

N79-29767# Royal Netherlands Meteorological Inst., De Bilt.
ON THE CHEMICAL COMPOSITION OF RAIN FALL: COMPARISON OF MEASUREMENT RESULTS [OVER DE CHEMIE VAN DE NEERSLAG: VERGELIJKING VAN MEETRESULTATEN]
T. B. Ridder 1978 85 p refs In DUTCH; ENGLISH summary
(KNMI-WR-78-4) Avail: NTIS HC A05/MF A01

Data collected at those three stations located in the

Netherlands of the European Atmospheric Chemistry Network (Rossby-Network) during the period 1956 to 1974 were evaluated and compared to independantly gathered data in order to verify the accuracy and validity of the Dutch sampling and analytical methods. Results indicate an unacceptably high rate of error, mainly due to a systematic underestimation of the problems encountered in analyzing often low amounts of pollution in precipitation. These difficulties are discussed in detail and corrected results for S04, pH, and N03 are given where possible. Finally, suggestions are made for improving methods and it is shown that Rossby-Network requirements can be met.
Author (ESA)

N79-29768# World Meteorological Organization, Geneva (Switzerland).
WORLD WEATHER WATCH: TENTH STATUS REPORT ON IMPLEMENTATION Status Report
1978 184 p
(WMO-518; ISBN-92-53-10518-9; Sr-10) Avail: NTIS HC A09/MF A01

The five topics dealt with are the Global Observing System (GOS), the Global Data-Processing System (GDPS), the Global Telecommunication System (GTS), monitoring of the Operation of the WWW, and the Use of WWW Facilities for Operational Hydrology. The GOS surface based sub-system is developing slowly. Considerable advances have been made in the GOS space based sub-system. Progress has been made in the implementation of GDPS. The introduction of medium/high speed data transmission has favored progress in the implementation of the GTS plan over the last four years. Observations and measurements data from the different stations are given in annexes.
Author (ESA)

N79-29769# Royal Netherlands Meteorological Inst., De Bilt.
METEOROLOGICAL OBSERVATIONS, YEARBOOK Annual Report
1978 74 p In DUTCH and ENGLISH
(KNMI-97-128) Avail: NTIS HC A04/MF A01; Roy. Neth. Meteorol. Inst. Fl 17.50

The results of observations made at 45 meteorological stations in the Netherlands from January 1, 1976 to December 31, 1976 are reported. A map showing the locations of the stations and information on the instrumentation and observation practices is provided. Meteorological parameters measured include air pressure, wind direction, wind velocity, temperature, relative humidity, vapor pressure, hourly solar radiation, sunshine, and amount as well as duration of precipitation. The data is also surveyed for daily, 10-day, and monthly trends. All data is presented in tabular form.
Author (ESA)

N79-29770# Royal Netherlands Meteorological Inst., De Bilt. Div. of Oceanographic Research.
METEOROLOGICAL AND OCEANOGRAPHIC OBSERVATIONS ON BOARD NETHERLANDS LIGHTVESSELS AND FROM THE LIGHT PLATFORM GOEREE IN THE NORTH SEA
Jul. 1978 170 p refs In DUTCH and ENGLISH
(KNMI-141-25) Avail: NTIS HC A08/MF A01

The observations made on board the Netherlands lightvessels during the year 1973 are presented. The meteorological observations made from the automatic observing station on the lightplatform Goeree are also included. Methods of observation for air pressure, air temperature, seawater temperature, amount of precipitation, and duration of precipitation as well as fog are outlined. Techniques for observing sea currents, salinity, period of sea and swell as well as height of sea and swell are also given. Other parameters measured include the fraction of the celestial dome covered by clouds, horizontal visibility, direction of wind and sea, and wind force. A comparison of past weather (6 hr prior to observation) with present weather at the moment of observation is also made in an attempt to identity weather breaks.
Author (ESA)

N79-29771# Royal Netherlands Meteorological Inst., De Bilt.
WEATHER FORECASTING FOR THE BUILDING INDUSTRY DURING WINTER 1975-76
J. J. Allan, A. P. A. Kleintjes, and D. M. vanderWoude 1978 27 p In DUTCH
(KNMI-V-304) Avail: NTIS HC A03/MF A01

Details on measured temperature, precipitation, wind, and weather phases (ranges of average 24 hr temperatures) in the Netherlands from 1 November 1977 to 31 March 1978 are given. Weather forecasts are compared with the actual outcome. Organization of the weather forecast procedure (by telephone) for the building industry is presented and an analysis of the use made of the system is given.
Author (ESA)

N79-29772# National Technical Information Service, Springfield, Va.
WIND SHEAR, VOLUME 1. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964-1975
Guy E. Habercom, Jr. Dec. 1978 208 p
(NTIS/PS-78/1314/0) Avail: NTIS HC $28.00/MF $28.00 CSCL 04B

The phenomena of wind shear effects in various environments are investigated in these Government-sponsored research reports. Aircraft, spacecraft launchings, atmospheric turbulence, and air/water interactions are among the areas reviewed. This updated bibliography contains 203 abstracts, none of which are new entries to the previous edition.
GRA

N79-29773# National Technical Information Service, Springfield, Va.
WIND SHEAR, VOLUME 2. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1976 - Nov. 1978
Guy E. Habercom, Jr. Dec. 1978 150 p Supersedes NTIS/PS-77/1172; NTIS/PS-76/1040; NTIS/PS-75/874
(NTIS/PS-78/1315/7; NTIS/PS-77/1172; NTIS/PS-76/1040; NTIS/PS-75/874) Avail: NTIS HC $28.00/MF $28.00 CSCL 04B

The phenomena of wind shear effects in various environments are investigated in these Government-sponsored research reports. Aircraft, spacecraft launchings, atmospheric turbulence, and air/water interactions are among the areas reviewed. This updated bibliography contains 145 abstracts, 65 of which are new entries to the previous edition.
GRA

48 OCEANOGRAPHY

Includes biological, dynamic and physical oceanography; and marine resources.

N79-29774 Washington Univ., Seattle.
STATISTICAL DESCRIPTION OF INTERNAL WAVES AND TEMPERATURE FINE STRUCTURE IN THE DEEP OCEAN Ph.D. Thesis
Murray David Levine 1979 187 p
Avail: Univ. Microfilms Order No. 7917595

Temperature fluctuations in the deep ocean are attributed to two distinct physical phenomena: the advection of a mean temperature gradient by an internal gravity wave field and the nonuniformity of the temperature field itself, termed fine structure. The observable temperature is modeled as the vertical displacement of a passive, horizontally uniform temperature field by a random sum of internal waves. The statistical model is then fit to a set of temperature measurements, consisting of vertical profiles and moored time series, taken in the Northeastern Pacific near Cobb seamount in summer 1977. This simultaneous spatial and temporal sampling allowed the self-consistency of the model to be established and permitted identification of observed variance as either internal waves or fine structure.
Dissert. Abstr.

N79-29775 Florida State Univ., Tallahassee.
A STUDY ON THE NORTHWARD INTRUSION OF THE LOOP CURRENT IN THE GULF OF MEXICO Ph.D. Thesis
Yin Shang Soong 1978 139 p
Avail: Univ. Microfilms Order No. 7917085

The dynamics of the northward intrusion of the loop current is theoretically investigated. A mathematical model of the current is formulated in a streamwise curvilinear coordinate system. An equation governing the path of a current of strong inertial is derived. This equation is used to determine the path formation of the loop current with the topography of the eastern

Gulf of Mexico included. The results agree well with observed loop current pathlines that occur south of latitude 25 deg N. Upon allowing a quasi-geostrophic balance for the model flow in the current a path equations is derived. This approach brings about an additional feature in that the influence of the flow outside the current is now parameterized as boundary conditions that determine the manner in which the current profile is modified downstream. Dissert. Abstr.

N79-29776 Oregon State Univ., Corvallis.
TIDES ON THE WEST FLORIDA SHELF Ph.D. Thesis
Chester John Koblinsky 1979 117 p
Avail: Univ. Microfilms Order No. 7917873

Two significant factors were found to contribute to the complexity of the diurnal tides in this region. First, the Gulf of Mexico is bordered to the North by 30 deg N latitude, where the inertial and diurnal frequencies coincide. Secondly, the diurnal frequencies are near a basin resonance of the Gulf. The depth independent K1 currents appear related to the external tide and are about 5 cm/sec. The depth dependent K1 currents approximate the magnitude of the depth independent currents and contain several characteristics of inertial motions. A detailed analysis of the dynamics and energetics of the M2 tide revealed that the currents are predominantly depth independent and stationary. The dynamics over the middle and outer shelf are linear and inviscid. The cross shelf flow increases toward the coast and is the dominant contributor to the sea level change. Dissert. Abstr.

N79-29777 Florida State Univ., Tallahassee.
EVIDENCE FOR WIND FORCED CIRCULATION IN THE GULF OF MEXICO Ph.D. Thesis
John Paul Blaha 1978 150 p
Avail: Univ. Microfilms Order No. 7917020

The circulation in the Gulf of Mexico is examined through the correlation of sea level with wind stress, curl, longshore wind stress, and dynamic height. Dissert. Abstr.

N79-29778# RAND Corp., Santa Monica, Calif.
A TIDAL SURVEY FOR A MODEL OF AN OFFSHORE AREA
W. J. VanDeRee (Rijkswaterstaat, Delta Serv., Neth.), J. Voogt (Rijkswaterstaat, Delta Serv., Neth.), and J. J. Leendertse Sep. 1978 17 p refs
(P-6248) Avail: NTIS HC A02/MF A01

Tides and currents in the Eastern and Western Scheldt and in a section of the North Sea were measured in order to establish boundary conditions as well as adjust and verify the Randdelta 2 model being used in the construction of a storm surge barrier for the southwestern Netherlands. The instruments used for current and pressure recording are described as well as the processing and reduction of data from the bottom pressure recorder, and the preparation of data for model input. A.R.H.

N79-29779# Washington Univ., Seattle. Dept. of Oceanography.
INTERNATIONAL DECADE OF OCEAN EXPLORATION. COASTAL UPWELLING ECOSYSTEMS ANALYSIS. DATA REPORT 45. JOINT-2 R/V MELVILLE LEGS 1, 2 AND 4, R/V ISELIN LEG 2, BOTTLE DATA, MARCH - MAY 1977
A. J. Hafferty, L. A. Codispoti, and A. Huyer Aug. 1978 783 p refs Sponsored by NSF
(PB-293930/4; NSF/IDOE/CUEA/DR-45; REF-M78-48) Avail: NTIS HC A99/MF A01 CSCL 08J

A study of the Peruvian upwelling system, organized and conducted by the Coastal Upwelling Ecosystems Analysis group and supported by the International Decade of Ocean Exploration program and the Instituto del Mar del Peru was reported. Hydrographic stations were taken from the R/V Melville and R/V Iselin during March - May 1977. Comments on the quality of the bottle data taken at these stations are presented. GRA

N79-29780# National Geophysical and Solar-Terrestrial Data Center, Boulder, Colo.
PROCEEDINGS OF MARINE GEOLOGICAL DATA MANAGEMENT WORKSHOP
Herbert Meyers, Michael S. Loughridge, and J. Bruce Grant Dec. 1978 12 p Workshop held at Boulder, Colo., 22 - 24 May 1978
(Grant NSF OCE-77-29270)
(PB-295409/7; NSF/IDOE-79/34) Avail: NTIS HC A02/MF A01 CSCL 08G

The needs of improving or establishing data bases for engineering properties, rock geochemistry, surficial sediment characteristics etc. were evaluated and endorsed. It was emphatically agreed that data user requirements should be the major driving force in establishing a data management system. A review of the methods used by several major institutions to identify a marine geological sample shows considerable differences from institution to institution and suggests a pressing need to standardize the methodology so that subsequent analyses performed on a sample can be traced or compared. GRA

N79-29781# Woods Hole Oceanographic Institution, Mass.
HYDROGRAPHIC STATION DATA OBTAINED IN THE VICINITY OF NANTUCKET SHOALS, MAY, JULY, SEPTEMBER 1978
R. Limeburner and R. C. Beardsley Jan. 1979 94 p refs
(Grants NOAA-04-7-158-44104; NOAA-04-8-M01-149)
(PB-295886/6; WHOI-79-30; NOAA-79041706) Avail: NTIS HC A05/MF A01 CSCL 08J

Three cruises were made during May, July, and September 1978, to measure the regional hydrographic structure in the vicinity of Nantucket Shoals on the New England Continental Shelf. The hydrographic observations made during Cruise NS1, NS2, and NS3, on the R/V EDGERTON are summarized. GRA

N79-29782# National Marine Fisheries Service, Seattle, Wash.
VERTICAL SECTIONS OF SEMIMONTHLY MEAN TEMPERATURE ON THE SAN FRANCISCO-HONOLULU ROUTE: FROM EXPENDABLE BATHYTHERMOGRAPH OBSERVATIONS, JUNE 1966 - DECEMBER 1974
J. F. T. Saur, L. E. Eber, D. R. McLain, and C. E. Dorman Jan. 1979 39 p refs
(PB-295685/2; NOAA-TR-NMFS-SSRF-728;
NOAA-79042003) Avail: NTIS HC A03/MF A01 CSCL 08J

The analyses reveal geographic and temporal facets of the mean thermal structure, including: (1) depth of the surface mixed layers in winter; (2) growth and decay of the seasonal thermocline; (3) decrease in depth of the permanent thermocline from Oahu to the California coast; (4) a region of temperature inversions or very weak vertical temperature gradients that develop between 50 and 100 m during the spring in the Transition Zone; and (5) the location and movement of warming and cooling regions during the year. GRA

N79-29783# Dames and Moore, Los Angeles, Calif.
THE MISSISSIPPI, ALABAMA, FLORIDA, OUTER CONTINENTAL SHELF BASELINE ENVIRONMENTAL SURVEY, MAFLA. 1977/1978. VOLUME 1-B: EXECUTIVE SUMMARY REPORT Final Report
26 Jan. 1979 30 p
(Contract DI-AA550-CT7-34)
(PB-294228/2; Rept-08699-008-88-Vol-1-B;
BLM/YM/ES-79/02-Vol-1-B) Avail: NTIS HC A03/MF A01 CSCL 13B

Potential impacts on the outer continental shelf (OCS) environment from oil and gas development are discussed. Methodology, geology, physical oceanography, chemistry, and biology are among the factors considered. A brief summary and lists of recommended monitoring parameters and major deficiencies in the data base are also included. GRA

51 LIFE SCIENCES (GENERAL)

Includes genetics.

N79-29784*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
BIOSPEX: BIOLOGICAL SPACE EXPERIMENTS, A COMPENDIUM OF LIFE SCIENCES EXPERIMENTS CARRIED ON US SPACECRAFT
Michele Anderson (Technology, Inc., Houston, Tex.), John A. Rummel, ed., and Stanley Deutsch, ed. (NASA, Washington) Jun. 1979 310 p refs

(NASA-TM-58217) Avail: NTIS HC A14/MF A01 CSCL 06C

United States space life science experiments, encompassing 27 years of experience beginning with sounding rocket flights carrying primates (1948) to the last U.S. spaceflight, the joint US/USSR Apollo Test Project (1975), are presented. The information for each experiment includes Principal Investigators, the program and mission on which it was flown, the specimens used, the objectives, protocol, equipment, results, conclusions, and bibliographic reference citations for publications derived from each experiment. J.M.S.

N79-29785# Research Inst. of National Defence, Stockholm (Sweden).

BIOLOGICALLY ACTIVE SHORT-CHAIN PEPTIDES

Ann Uddgard Sep. 1977 65 p refs In SWEDISH; ENGLISH summary

(FOA-C-40063-C1) Avail: NTIS HC A04/MF A01

Peptides consisting of a maximum of 14 amino acids and their biological possessing activity are described. The substances are broken down according to the physiological systems mainly affected by them. Among peptides affecting the nervous system, the most interesting are endorphines, apamine, PCPA and scotophobine. Apamine and PCPA cause powerful mental and motor disturbance over relatively long periods. Scotophobine raises questions as to the learning and transference of specialized behaviour by a chemical substance. Many peptides exert their effect on the blood-pressure level, and produce marked symptoms. They include eledoisine, hypotensine and MDF. Amatoxins and phallotoxins affect the liver and are highly toxic. A convulsion-producing peptide which is effective in small doses is bombesine. R.E.S.

N79-29786# Scientific Translation Service, Ann Arbor, Mich.

CELL BIOLOGY BASIS FOR THE LIFE OF AN ORGANISM IN THE RADIATION FIELD

T. M. Fliedner, K. H. Steinbach, and H. Raffler Nov. 1978 16 p refs Transl. into ENGLISH from Atomwirtschaft (West Germany), v. 21, no. 6, Jun. 1976 p 292-297 Sponsored by DOE Prepared for Argonne Natl. Lab., Ill.

(ANL-Trans-1152) Avail: NTIS HC A02/MF A01

The following topics are discussed: the human biosphere; temperature control mechanisms; the radiation field in the human environment; extraordinary isolated radiation exposure; chronic radiation exposure; structure, function, and regulation of cell regeneration systems; stimulation of the radiation reaction of cell systems; and effects of dose rate on the content of the pluripotential stem cell pool. Author (DOE)

N79-29787# Chemical Lab. RVO-TNO, Rijswikj (Netherlands).

BINDING OF BIOLOGICALLY ACTIVE AGENTS TO PLASMA PROTEINS

J. Mourik Aug. 1977 38 p refs In DUTCH; ENGLISH summary

(CL-1977-22) Avail: NTIS HC A03/MF A01

Some factors that influence binding to plasma proteins are discussed. Biologically active agents of low molecular weight are transported by the bloodstream. The origin of these agents can be endogeneous or exogeneous. Binding to plasma proteins, particularly to albumin, is of great influence on the distribution and activity of the agents in the body. The binding builds up a buffer store of a biologically active agent resulting in a prolonged time of action and a decreased acute activity. The binding to plasma proteins in vitro can be determined quantitatively with methods on separation of free and bound ligand or with methods based on the difference of physical properties of free and bound ligand. The last mentioned methods can give insight also into the molecular mechanism of protein binding. Quantitative data on binding is evaluated with statistical or graphic methods. A review is also given of data on binding to protein-insecticide complexes obtained from studies with organochlorine and organophosphate insecticides. Author (ESA)

N79-29788# Maryland Univ., Solomons. Chesapeake Biological Lab.

RESULTS OF BENTHIC STUDIES AT CALVERT CLIFFS

A. F. Holland, N. K. Mountford, M. Hiegel, K. Kaumeyer, and D. Cargo Dec. 1978 245 p refs

(Contract AT(40-1)-4238)

(PB-294261/3; UMCEES-78-165-CBL; PPSP/MMC/CC-78/2) Avail: NTIS HC A11/MF A01 CSCL 13B

The effect of the thermal plume on the benthic communities near the Calvert Cliffs nuclear power plant during the 1976-1977 period were evaluated using ANOVA, cluster analysis, and multivatiate community analysis. Several changes in community structure were noted. GRA

52 AEROSPACE MEDICINE

Includes physiological factors, biological effects of radiation; and weightlessness.

N79-29789 Michigan Univ., Ann Arbor.

A STOCHASTIC MODEL OF MUSCLE FATIGUE IN FREQUENT STRENUOUS WORK CYCLES Ph.D. Thesis

Myun Woo Lee 1979 224 p

Avail: Univ. Microfilms Order No. 7916756

An analytic and quantitative muscle fatigue model is important for the selection of effective work and rest periods for jobs requiring strenuous static strength and high frequency of exertions. Three Markov models of muscle fatigue are developed. These models are based on motor unit fatigue-recovery characteristics obtained from information on motor unit behavior, in particular, the amplitude, duration, and frequency of the muscle action potential (MuAP) as it relates to fatigue and graded exertions. These models also depend on a relationship developed between the recruitment of motor units and the EMG amplitude to explain muscle fatigue for various sequences of static contractions.

Dissert. Abstr.

N79-29790 Michigan Univ., Ann Arbor.

ISOMETRIC STRENGTH TESTING IN SELECTING WORKERS FOR STRENUOUS JOBS Ph.D. Thesis

William Monroe Keyserling 1979 224 p

Avail: Univ. Microfilms Order No. 7916744

Research was conducted to determine if strength testing can be used to reduce occupational illness and injuries which result from a mismatch between the strength abilities of workers and the strength demands of their jobs. To accomplish this, two field studies were performed in industrial plants. It was concluded that strength testing can be used to identify workers who would be at increased risk of suffereing a medical incident if placed on jobs with strength demands above their strength abilities.

Dissert. Abstr.

N79-29791# Istituto Superiore di Sanita, Rome (Italy).

COMPUTED AXIAL TOMOGRAPHY (CAT)

F. P. Gentile, F. Sabetta, and V. Troi (Ospedale S. Camillo, Rome) 15 Mar. 1978 76 p refs In ITALIAN; ENGLISH summary (ISS-R-78/4) Avail: NTIS HC A05/MF A01

Current literature on computed tomography (CT) is reviewed. The working procedures for the CT machine are presented, and the contribution of this new radiological technique to the medical field is analyzed. Finally, the risk-benefit ratio is considered with particular attention to the dose received by the patient during a typical tomographic examination. Author (ESA)

N79-29792# Unilever Research, Vlaardingen (Netherlands).

ASPECTS OF DIETARY PREVENTION OF ARTERIOSCLEROSIS

A. J. Vergroesen, J. J. Gottenbos, and F. Tenhoor 1978 39 p refs Submitted for publication

Avail: NTIS HC A03/MF A01

After a brief characterization of the chronic, degenerative disease, atherosclerosis, a dietary approach to a cure, concentrating on some less well-known physiological effects of increased linleic acid and decreased saturated-fat consumption on arterial blood pressure, thrombotic tendency of blood platelets, cardiac function, and carbohydrate metabolism in diabetes mellitus, is described. In conclusion it is claimed hypoenergetic diets will induce significant decreases in body weight and blood cholesterol, triglyceride and insulin levels, and will normalize most cases of maturity onset diabetes. After ideal body weight is reached, it

is recommended that a normal maintenance diet be used.
Author (ESA)

N79-29793# Medical Physics Inst. Utrecht (Netherlands).
GENERAL ACTIVITIES RELATED TO MEDICAL RESEARCH Progress Report, 1978
B. vanEijnsbergen and F. L. LopesdaSilva Dec. 1978 241 p refs
(TNO-MFI-PR-6) Avail: NTIS HC A03/MF A01

Highlights of the activities of the three departments (Medical technology; Physics in Medicine; and Biomedical and Brain Research) of the institute during a two year period are presented. Fields of study include 'rehabilitation and motorfunctions', 'brain functions and structure', 'biomathematics', and 'circulation'. Progress made in the field of instrumentation and computer techniques is also reported. Results are presented relative to the main objective of the Institute's investigations, which is 'the recording and analysis of biomedical signals'. Clinical applications are emphasized.
Author (ESA)

53 BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

No abstracts in this category.

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing.

N79-29794*# Life Systems, Inc., Cleveland, Ohio.
ELECTROCHEMICALLY REGENERABLE CARBON DIOXIDE ABSORBER Final Report
R. R. Woods, R. D. Marshall, F. H. Schubert, and D. B. Heppner Aug. 1979 63 p refs
(Contract NAS2-8666)
(NASA-CR-152099; LSI-ER-290-3) Avail: NTIS HC A04/MF A01 CSCL 06K

Preliminary designs were generated for two electrochemically regenerable carbon dioxide absorber concepts. Initially, an electrochemically regenerable absorption bed concept was designed. This concept incorporated the required electrochemical regeneration components in the absorber design, permitting the absorbent to be regenerated within the absorption bed. This hardware was identified as the electrochemical absorber hardware. The second hardware concept separated the functional components of the regeneration and absorption process. This design approach minimized the extravehicular activity component volume by eliminating regeneration hardware components within the absorber. The electrochemical absorber hardware was extensively characterized for major operating parameters such as inlet carbon dioxide partial pressure, process air flow rate, operational pressure, inlet relative humidity, regeneration current density and absorption/regeneration cycle endurance testing.
R.E.S.

N79-29795# Navy Clothing and Textile Research Unit, Natick, Mass.
INSULATED FIREFIGHTERS' CRASH-CREW RESCUE BOOTS AND COMPONENTS: FIELD AND LABORATORY EVALUATION Final Report, Oct. 1976 - Sep. 1977
Milton Bailey Tyndall AFB, Fla. CEEDO Dec. 1978 43 p refs
(AFCEC Proj. 77-02; AF Proj. 414N)
(AD-A068264; NCTRF-137; CEEDO-TR-78-07) Avail: NTIS HC A03/MF A01 CSCL 06/17

The Navy Clothing and Textile Research Facility (NCTRF) conducted an evaluation of commercial insulated firefighters' boots worn by crash firefighters representing three Navy Air Stations and three Air Force Bases. The evaluation revealed that the insulated footwear was significantly superior to the standard firefighters' boots currently in the supply system. Reflective spats, accessories sometimes used to cover boots for additional protection against high heat, were considered unnecessary by the subjects who thought the insulation of the test boots provided sufficient protection. Laboratory findings, however, showed that spats would indeed be needed if personnel became immobilized and were subjected to 1.89 gcal/sq cm/sec heat for 30 seconds or longer. The laboratory tests also showed that the heat rapidly penetrates and destroys soiled aluminized fabrics. Based on these findings, NCTRF recommends: (1) insulated firefighters' boots replace standard firefighters' boots; (2) commercial aluminized spats be stocked as supporting gear; and (3) reflectivity of aluminized fabrics generally, and of spats particularly, be policed and maintained daily to assure peak personnel protection at all times.
GRA

N79-29796# Gulf and Western Applied Science Labs., Waltham, Mass.
SENSORY MECHANISM MODELING Final Report, Jun. 1977 - Sep. 1978
Joshua Borah, Laurence R. Young, and Renwick F. Curry Feb. 1979 87 p refs
(Contract F33615-76-C-0039; AF Proj. 6114)
(AD-A069439; AFHRL-TR-78-83) Avail: NTIS HC A05/MF A01 CSCL 06/4

Pilots use information from a variety of sensory mechanisms to determine their estimate of orientation and motion. An understanding of this process and a quantitative model are essential for development of effective simulator motion cueing devices. A multisensory model for dynamic spatial orientation is being developed for this purpose. Aircraft or simulator motion is translated into stimuli which are processed by dynamic models of the appropriate sensors (visual, vestibular, tactile, and proprioceptive), and are then fed to a central estimator which has been modeled as a linear optimal estimator, specifically a steady state Kalman Filter. In addition to the linear estimation process, some non-linear effects, such as the well documented delay in onset of visually induced motion, require non-linear additions to the model. Such additions have been kept to a minimum so as to retain the uniqueness and conceptual appeal of a linear optimization algorithm. The model has been implemented as a computer program and has predicted some of the important qualitative characteristics of human dynamic spatial orientation under combined wide field visual motion and platform motion. Several types of special tactile and proprioceptive cues are also being considered but have not been validated. The modeling effort has underscored the need for additional data in some areas and several experiments have been suggested to help fill these gaps.
GRA

N79-29797# Research Inst. of National Defence, Stockholm (Sweden).
HUMAN PROCESSING OF INFORMATION AND THE COMPUTERIZED MODE OF PRESENTATION: ERGONOMIC PARAMETERS [MAANSKLAG INFORMATIONSBEARBETNING OCH DATORISERAT PRESENTATIONSSAATT: EN REFERENSRAM]
Mette Holmgren Nov. 1978 25 p refs In SWAHILI
(FOA-C-56018-H9) Avail: NTIS HC A02/MF A01

A theoretical frame of reference for human processing of computerized information is given. The definition of an average person's cognitive ability was primarily sought, but individual behavioral differences were also taken into account. Experimental psychology and the theory of personality development were used along with statistical analysis. The abstraction level, the stress involved in real time work, and individual difference mainly due to training and emotional factors were topics considered.
Author (ESA)

55 PLANETARY BIOLOGY

Includes exobiology and extraterrestrial life.

No abstracts in this category.

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

No abstracts in this category.

60 COMPUTER OPERATIONS AND HARDWARE

Includes computer graphics and data processing.

For components see *33 Electronics and Electrical Engineering*.

N79-29798 Michigan State Univ., East Lansing.
A GENERAL PURPOSE ELECTROANALYTICAL SYSTEM BASED ON A MICROCOMPUTER CONTROLLED COULOSTATIC GENERATOR Ph.D. Thesis
Spyros Emmanouel Hourdakis 1978 198 p
Avail: Univ. Microfilms Order No. 7917713

A microcomputer controlled and operated electrochemical analysis system was developed and, in its polarographic mode, it was shown to be more sensitive than polarography in the determination of cadmium. A charge generator was designed which uses the charge injection technique to add charge pulses into the electrochemical cell. The characteristics of the charge generator were studied and its operation is discussed. The function of the charge generator is the injection of charges into the cell and the function of the voltage measurement system. The advantages of the multimicrocomputer system over the single microcomputer, for real time control of the instrument, are the speed, the modularity, and the convenience of the programming of the system. The electrochemical system was applied in the polarographic determination of cadmium. Dissert. Abstr.

N79-29799 Pittsburgh Univ., Pa.
AN INTERACTIVE SELF-DOCUMENTING COMPUTER INTERFACE SYSTEM TO AID USAGE OF THE SPSS STATISTICAL APPLICATION PACKAGE Ph.D. Thesis
Thomas E. Wolf 1978 194 p
Avail: Univ. Microfilms Order No. 7917447

A sample interaction between a user and the interface system was generated. The sample conversation which showed a typical user session with the interface system, was evaluated by means of a questionnaire. A study guide to aid the usage of the interface system was developed using the sample conversation as a blueprint. The study guide showed the basic information which the interface would request and also contained a summary of the SPSS procedures. The study guide was then evaluated by means of a questionnaire, and slight program guide modifications made. A complete interface system implemented using the FORTRAN language was developed and on a PDP-10 computer. The system was then evaluated through student use.
Dissert. Abstr.

N79-29800 Virginia Univ., Charlottesville.
DESIGN OF A MILTI-MICROPROCESSOR SYSTEM FOR REAL-TIME AIRCRAFT SIMULATION Ph.D. Thesis
Young Chang Lee 1978 208 p
Avail: Univ. Microfilms Order No. 7916283

With the use of low cost LSI microprocessors operating in parallel, a fast and yet inexpensive modularly constructed aircraft simulator is envisioned. A system architecture that yields effective parallel processing for the special purpose digital computer system is presented. Special concern is given to comparisons of the simulation accuracy obtaiable on the multimicroprocessor system as compared to that obtained on a large computer. The determination of the optimum sampling rates which would give the best simulation accuracy on the multi-microprocessor system which has a relatively short word length was studied. They are determined as functions of the characteristic frequencies of the system simulated, the word size of the digital machine, and the discretization method used for the simulation. It is concluded that the multimicroprocessor system can be used as a fast, accurate and yet low cost computing resource for certain real time aircraft simulation problems if a judicious design approach is taken. Dissert. Abstr.

N79-29801 Stanford Univ., Calif.
MONITORING SYSTEM BEHAVIOR IN A COMPLEX COMPUTATIONAL ENVIRONMENT Ph.D. Thesis
Mitchell L. Model 1979 188 p
Avail: Univ. Microfilms Order No. 7917263

Appropriate monitoring tools for complex systems, in particular the representation systems of artificial intelligence research were developed. The foundation for the design approach is provided. Certain facts concerning limitations on human information processing abilities which formed the background for much of the research are introduced. The nature of computer programs is discussed, and a concept of computational behavior defined. Traditional debugging tools are presented. Observation of program behavior (monitoring) is shown to be the main function of most debugging tools and techniques. An approach to the design of monitoring facilities for complex systems is presented. The need for system level tools similar to the ones traditionally available is indicated. A concept called meta-monitoring replaces traditionaly dumps and traces with selective reporting of high level information about computations. Dissert. Abstr.

N79-29802# Naval Intelligence Processing System Support Activity, Alexandria, Va.
THE IMPACT OF DBMS ON ADP MANAGEMENT
Mar. 1979 27 p
(AD-A068444) Avail: NTIS HC A03/MF A01 CSCL 09/2

This paper describes the impact of implementing a major database management system (DBMS) in a batch data processing environment and the changes which have transpired in the four years since IDMS was installed. Emphasis is on the management view of the change and what future trends in management requirements can be expected based on past experience. GRA

N79-29803# Stanford Univ., Calif. Dept. of Computer Science.
CONSIDERATIONS FOR MICROPROCESSOR-BASED TERMINAL DESIGN
Reid G. Smith and Tom M. Mitchell (Rutgers, the State Univ. of N. J., New Brunswick) Dec. 1978 17 p refs Presented at the 12th Ann. Asilomar Conf. on Circuits, Systems, and Computers, Pacific Grove, Calif., 6-8 Nov. 1978
(Contract MDA903-77-C-0322)
(AD-A068538; SU-STAN-CS-78-696; HPP-78-22) Avail: NTIS HC A02/MF A01 CSCL 09/2

We discuss the design of hardware and software for inexpensive microprocessor-based terminal/microcomputers. Such devices are fundamentally microcomputers that have been adapted, with specialized software, to operate as remote terminals for a host computer. The discussion centers on a specific video terminal designed and constructed by the authors. This terminal is based on the INTEL 8080 microprocessor and is equipped with software sufficient to emulate the characteristics of standard video terminals required by several available screen-oriented text editors in common use at sites through the ARPANET. We have found that the microprocessor adequately serves as the controller for such terminals, and that a software-based approach to the design of such terminals offers substantial advantages in capabilities, flexibility, and cost over the hardware-based approach. We suggest guidelines for future designs of microproces-

sor-based terminals on the basis of our experience designing and using the terminal described here. GRA

N79-29804# Wisconsin Univ. - Madison. Mathematics Research Center.
NONSTANDARD ARITHMETIC PACKAGES FOR FORTRAN Summary Report
J. M. Yohe Jan. 1979 27 p refs
(Contract DAAG29-75-C-0024)
(AD-A068929; MRC-TSR-1907) Avail: NTIS HC A03/MF A01 CSCL 09/2

We describe various available supporting packages for the AUGMENT precompiler for FORTRAN, and provide instructions for their use in conjunction with AUGMENT. GRA

N79-29805# Aeronautical Systems Div., Wright-Patterson AFB, Ohio.
PROCEEDINGS OF THE 2ND AFSC MULTIPLEX DATA BUS CONFERENCE, VOLUME 2 Final Report
Erwin C. Gangl 12 Oct. 1978 844 p refs Conf. held at Dayton, Ohio, 10 - 12 Oct. 1978
(AD-A068310; ASD-TR-78-34-Vol-2) Avail: NTIS HC A99/MF A01 CSCL 17/2

This is a collection of unclassified papers presented by U.S. and international government and industry personnel at the second AFSC Multiplex Data Bus Conference at the Convention Center, Dayton, Ohio. The purpose of the conference is to exchange information on data bus technology and collect lessons learned for future systems applications. GRA

N79-29806# Stanford Univ., Calif. Dept. of Computer Science.
A FRAMEWORK FOR PROBLEM SOLVING IN A DISTRIBUTED PROCESSING ENVIRONMENT
Reid Garfield Smith Dec. 1978 159 p refs
(Contracts MDA903-77-C-0322)
(AD-A068230; SU-STAN-CS-78-700; HPP-78-28) Avail: NTIS HC A08/MF A01 CSCL 09/2

The concept of distributed problem solving, or the cooperative solution of problems by a decentralized and loosely-coupled collection of knowledge-sources that operates in a distributed processor architecture is presented. Such architectures offer high-speed, reliable computation at low cost and are an effective way to utilize the new LSI processors and the developments of the recent synthesis of computer and communications technology. A conceptual framework called the contract net framework that specifies communications, control, and knowledge organization has been developed. Task distribution is viewed as an interactive process, a discussion carried on between a node with a task to be executed and a group of nodes that may be able to execute the task. This is the origin of the contract metaphor for control, where task distribution corresponds to contract negotiation. The types of knowledge used in such a problem solver are discussed, together with the ways that the knowledge is indexed within an individual node and distributed among the collection of nodes. The use of two primary types of knowledge (referred to as task-centered and knowledge-source centered) is shown. We illustrate the kinds of information that must be passed between nodes in the distributed processor in order to carry out task and data distribution. We suggest that a common internode language is required and that the task-specific expertise required by a processsor node can be obtained by internode transfer of procedures and data. GRA

N79-29807# Massachusetts Inst. of Tech., Cambridge. Lab. for Computer Science.
A SEMANTIC DATA BASE MODEL AND ITS ASSOCIATED STRUCTURED USER INTERFACE Ph.D. Thesis
Dennis McLeod Aug. 1978 381 p refs
(Contract N00014-76-C-0944)
(AD-A068112; MIT/LCS/TR-214) Avail: NTIS HC A17/MF A01 CSCL 09/2

The conventional approaches to the structuring of data bases provided in contemporary data base management systems are in many ways unsatisfactory for modelling data base application environments. The features they provide are too low-level, computer-oriented, are representational to allow the semantics of a data base to be directly expressed in its structure. The semantic data model (SDM) has been designed as a natural application modelling mechanism that can capture and express the structure of an application environment. The features of the SDM correspond to the principal intensional structures naturally occurring in contemporary data base applications. The SDM provides a rich but limited vocabulary of data structure types and primitive operations, striking a balance between semantic expressibility and the control of complexity. Furthermore, facilities for expressing derived (conceptually redundant) information are an essential part of the SDM; derived information is as prominent in the description of an SDM data base as is primitive data. The SDM is designed to enhance the effectiveness and usability of data base systems. There are many data base management systems in use today which represent a considerable investment on the parts of their developers and users; the SDM can be effectively used in conjunction with these existing data base systems to enhance their effectiveness and usability. GRA

N79-29808# University of Southern California, Los Angeles. Dept. of Computer Sciences.
MULTIPROCESSOR ARCHITECTURES FOR CONCURRENT PROGRAMS
Per Brinch Hansen 8 Apr. 1978 21 p refs
(Contract N00014-77-C-0714; NR Proj. 049-415)
(AD-A068162) Avail: NTIS HC A02/MF A01 CSCL 09/2

This paper proposes a hierarchical multiprocessor architecture for real-time programs written in a concurrent programming language. The use of processes and monitors leads to a multiprocessor system in which each processor has a local store dedicated to a single process. The processors share a common store that contains the monitors. To avoid congestion in the common store the processes and monitors are partitioned into subsystems that share a hierarchy of common stores. The main goal is to develop a synthesis of an abstract language and a computer architecture that match in an obvious way. GRA

N79-29809# Computer Corp. of America, Cambridge, Mass.
SPATIAL DATA MANAGEMENT SYSTEM Quarterly Research and Development Technical Report, 1 Dec. 1978 - 28 Feb. 1979
Christopher F. Herot, David Kramlich, Richard Carling, Mark Friedell, and Jerry Farrell 28 Feb. 1979 86 p refs
(Contract MDA903-78-C-0122; ARPA Order 3487)
(AD-A068451) Avail: NTIS HC A05/MF A01 CSCL 09/2

This fifth quarter of work on the design and implementation of a prototype Spatial Data Management System (SDMS) resulted in the addition of several new capabilities to the operational prototype. These capabilities provide: (1) a means of controlling the detail at which data is presented; and (2) additional flexibility in the appearance of graphical displays of symbolic data. In addition, a mechanism for maintaining the correspondence between symbolic and graphical forms of data was designed and will be implemented during the coming two quarters. GRA

N79-29810# Rochester Univ., N. Y. Dept. of Computer Science.
VTMS: A VIRTUAL TERMINAL MANAGEMENT SYSTEM FOR RIG
Keith A. Lantz and Richard F. Rashid May 1979 41 p refs
(Contract N00014-78-C-0164; Grant NSF MCS-76-10825)
(AD-A069458; TR-44) Avail: NTIS HC A03/MF A01 CSCL 09/2

Rochester's Intelligent Gateway provides its users with the facilities for communicating simultaneously with a large number of processes spread out among various computer systems. We have adopted the philosophy that the user should be able to manage any number of concurrent tasks or jobs, viewing their output on his display device as he desires. To achieve this goal a single physical terminal is converted in multiple virtual terminals, each of which may be written into or queried for user input. Virtual terminals are device-independent and provide extensive editing facilities and the capacity to maintain all output on disk. GRA

N79-29811# Mons Univ. (Belgium). Dept. d'Astrophysique.
SOME IMPROVEMENTS ON THE LOGIC DESIGN OF THE 'BENSON' PRINTER [QUELQUES AMELIORATIONS AU LOGICAL POUR TABLE TRACANTE BENSON]

A. Delacroix 1977 12 p refs In FRENCH
(Commun-64) Avail: NTIS HC A02/MF A01

The logic design of the 'Benson' printer was enlarged so as to be able to handle more complex printing instructions. The programming is described before and after improvement in terms of the FORTRAN language. The printer capabilities are given in detail. The use of other computer languages, with the 'Benson' printer logic configuration is also discussed. Author (ESA)

N79-29812# Laboratorio di Ricerca e Technologia per lo Studio del Plasma nello Spazio, Frascati (Italy).
ASSEMBLING COMPILER FOR THE RCA CDP 1802
P. Cerulli-Irelli Oct. 1978 71 p refs
(LPS-78-13) Avail: NTIS HC A04/MF A01

A compiler program for the assembler language of the RCA 1802 microprocessor was written using an HP 2116 B calculator. The content of the program and its use are described. Author (ESA)

N79-29813# Research Inst. of National Defence, Stockholm (Sweden).
DIGITIZING AND HANDLING OF ANALOG REGISTERED MULTISPECTRAL SCANNER DATA
S. I. Aakersten, B. Engstroem, H. Lundgren, and S. E. Pettersson Oct. 1978 37 p refs Sponsored in part by Swed. Board for Space Activity
(FOA-C-30108-E1) Avail: NTIS HC A03/MF A01

The digitizing and handling of analog registered multispectral scanner (MSS) pictorial data are described. The data acquisition technique is briefly described as well as techniques and problems related to digitizing and subsequent data conditioning. Additional preprocessing tasks, essential to the further development of a system of computer aided evaluation of multispectral remote sensing data are given. Application possibilities for airborne MSS techniques are discussed. Author (ESA)

N79-29814# Research Inst. of National Defence, Stockholm (Sweden).
RECORDING AND VISUALIZATION OF INFRASOUND SIGNALS WITH THE AID OF MICROPROCESSORS [REGISTERING OCH PRESENTATION AV INFRALJUDSIGNALER MED HJAELP AV MIKROPROCESSOR]
F. Malmstroem and H. Nygren Dec. 1978 35 p In SWAHILI
(FOA-C-30153-E1) Avail: NTIS HC A03/MF A01

An infrasonic monitoring and recording system was built based on th the use of microprocessors. Descriptions of the peripheral apparatus and the programming of the microprocessor are presented. The signal processing system includes a detector unit, a microprocessor assembly, a clock device, an oscilloscope monitored by a camera, and a master oscilloscope for control. Author (ESA)

N79-29815# National Institutes of Health, Bethesda, Md. Div. of Computer Research and Technology.
PROJECT RMAG: SLANG (STRUCTURED LANGUAGE) COMPILER. USER'S GUIDE
Robert A. Magnuson May 1979 101 p refs
(PB-294145/8; NIH-DCRT-DMB-SSS-UG105; NIH/DF-002A) Avail: NTIS HC A06/MF A01 CSCL 09B

Designed to assist programmers writing powerful structured programs, the SLANG Compiler generates blockstructured IBM 370 assembly language source code. Based on six years experience developing and using the RMAG-implemented RMAGASM compiler, SLANG retains the important features of its predecessor while adding some original ones of its own. For example, SLANG's extension of the IF block permits the choice of n segments, while retaining (as a subset) the familiar two-segment choice. SLANG has its own macro facility (available during its operation) enabling the user to easily create long or complex sequences of SLANG commands and structures. Useful macros are created, tested, and saved independently. These macros can be made available to SLANG by the MACLIB command which references external libraries by ddname. Macro definitions are included directly with SLANG source programs. GRA

61 COMPUTER PROGRAMMING AND SOFTWARE

Includes computer programs, routines, and algorithms.

N79-29816 Syracuse Univ., N. Y.
A DYNAMIC PRIORITY SCHEDULING RULE WITH OPTIMIZATION FOR TRANSACTION PROCESSING SYSTEMS Ph.D. Thesis
Daniel Kinshoung Wood 1978 163 p
Avail: Univ. Microfilms Order No. 7914267

The use of a dynamic priority scheduling rule proposed by Kleinrock in a M/G/1 queueing model is presented as well as the study of its applicability as a scheduling rule for transaction processing systems. It was concluded that this scheduling rule is applicable for use in transaction processing systems. The capability of adjusting the control parameters to provide mean waiting times performance between that of first-come first serve and fixed priority scheduling allows the designer to select from a wide range of response times for different classes of transactions. Dissert. Abstr.

N79-29817 California Univ., Berkeley.
A SYSTEMATIC APPROACH TO THE DEVELOPMENT AND VALIDATION OF SOFTWARE FOR CRITICAL APPLICATIONS Ph.D. Thesis
Siu-Bun Franklin Ho 1978 212 p
Avail: Univ. Microfilms Order No. 7914639

The theoretical and practical issues of program validation are presented along with testing, symbolic execution, and software reliability measures. Symbolic execution and reliability measurement form the basis for a methodology for the development and validation of software for critical applications. Critical software is characterized by their small program size and high failure penalties. Exploiting these characteristics, the methodology incorporates dual specification and programming techniques to facilitate early error detection through intercomparisons. Some early experience in using the methodology for developing nuclear power plant safety software is reported. Dissert. Abstr.

N79-29818 California Univ., Berkeley.
ON SHORTEST PROGRAM FOR FINITE STRINGS, 1. A NEW SOLUTION OF THE CRITICAL SECTION PROBLEM, 2 Ph.D. Thesis
Howard Paul Katseff 1978 66 p
Avail: Univ. Microfilms Order No. 7914656

The program size complexity of binary strings is examined. A measure due to Kolmogorov is discussed. The graph of the finite strings (in lexicographic order) vs their complexities is presented. An important fact is that there is a constant c such that the complexities of two consecutive strings never differ by more than c. Thus the graph is a more or less continuous (in the intuitive sense) curve. One result is that flat spots, consecutive strings all with the same complexity, are of bounded length. The solution presented improves on previous solutions by allowing processes to enter their critical sections on a first-come first-served basis. Dissert. Abstr.

N79-29819 Yale Univ., New Haven, Conn.
SPLINE REGRESSION: ALGORITHMS AND LOCAL DEPENDENCE Ph.D. Thesis
John Winslow Lewis 1978 187 p
Avail: Univ. Microfilms Order No. 7915852

A unified theory of local dependence is developed for symmetric, positive definite, block tridiagonal matrices and the associated linear systems. The results include bounds on elements of the inverse, simple local dependence bounds, error bounds for local solutions to linear systems, error bounds for local inverses of matrices, and error bounds for local Cholesky factorizations of matrices. A detailed analysis of algorithms for computing and evaluating least-squares spline approximations to data is presented. The algorithms are given explicitly in an ALGOL-like language and operation counts are presented. Of particular interest are a fast incremental algorithm for evaluating splines and a limited-storage algorithm for computing piecewise polynomial representations of splines. Dissert. Abstr.

N79-29820 Arizona Univ., Tucson.
SOFTWARE DESIGN FOR SIMULATION AND INSTRUMENTATION Ph.D. Thesis
Steven Windes Conley 1979 214 p
Avail: Univ. Microfilms Order No. 7914433

Micro-DARE BASIC/RT11, an interactive digital simulation language based on previous DARE (Differential Analyzer Replacement) systems, is the first system to use BASIC as the programming language instead of FORTRAN or assembly language. DARE/RT11 is an upgrade of the DARE/ELEVEN system which was based on the PDP11 DOS operating system to the RT11 operating system. Both Micro-DARE BASIC/RT11 and DARE/RT11 run on any PDP-11 with the EIS instruction set, 28K words of memory, a console terminal (LS-120 or VT-100), and disk. DARE/RT11 requires a hard-disk of at least 2.5M byte capacity while MICRODARE will run on a two-drive floppy disk system. Both systems have built-in graphic routines for the VT11 graphics terminal. DARE/RT11 contains a lineprinter plotting package for any 132 character lineprinter. Dissert. Abstr.

N79-29821 Washington Univ., Seattle.
ON THE APPLICATION OF A PRIORI KNOWLEDGE OF PROGRAM STRUCTURE TO THE PERFORMANCE OF VIRTUAL MEMORY COMPUTER SYSTEMS Ph.D. Thesis
Rowan Snyder 1978 299 p
Avail: Univ. Microfilms Order No. 7917638

The relationship of the structure of computer programs to their performance in Virtual Memory system was investigated. Special attention is paid to using the information inherent in the compile time (FORTRAN) source code to improve performance. It is concluded that using a priori information for performance improvement is feasible, effective and significant. Dissert. Abstr.

N79-29822 Washington Univ., Seattle.
AMBIGUITY AND LR PARSING Ph.D. Thesis
Donn Scott Terry 1978 201 p
Avail: Univ. Microfilms Order No. 7917647

A practical system which aids significantly in the design of programming languages and their grammars is presented. A theoretical basis for the methods based on conflict resolved LR tables is discussed. The concept of an idiom of a language is introduced, which captures the concept of the structure of a programming language as seen by a user more accurately than either of the formal concepts of language or grammar. It is shown that a compressed table corresponds exactly to an LR(1) table arrived at by conflict resolution of the table for an ambiguous grammar. An inverse algorithm is developed, recovering an unambiguous grammar for the language parsed by a compressed table. These algorithms were implemented with a consistent interface to an SLR(1) parser generator. These algorithms and the SLR(1) parser generator may then be used to develop both an easily understood (possibly ambiguous) grammar and and equivalent unambiguous grammar for a programming language, and to provide reduced tables for the parser. Dissert. Abstr.

N79-29823 Michigan State Univ., East Lansing.
A MODEL OF PROGRAM PERFORMANCE IN MULTIPROGRAMMING SYSTEMS Ph.D. Thesis
Chester Terrance Trahan 1978 193 p
Avail: Univ. Microfilms Order No. 7917801

An analytic model for predicting computer performance for medium scale, priority-interrupt driven operating systems was developed with cyclic queuing submodels for the central processing unit and the input/output units and a deterministic independent reference submodel for program paging behavior. The model was programmed in APL and Newton's Method and Aitken's Delta Square algorithm were used to achieve convergence of the model to equilibrium solutions. A set of parameterization runs was made on a System/370 Model 148 and their measurements were then used to estimate the system parameters. A sizable error in page rates, channel utilization, overhead and CPU utilization was attributed to the inadequacy of the independent reference model in representing paging behavior. Modifications were then made to the model and the predictions of the revised paging model showed good agreement with the experimental data. Dissert. Abstr.

N79-29824 Stanford Univ., Calif.
A COMBINED SMOOTHING-IDENTIFICATION ALGORITHM Ph.D. Thesis
Andrew Brian Cox 1979 67 p
Avail: Univ. Microfilms Order No. 7917219

An offline algorithm is developed for identification of parameters of linear, stationary, discrete, dynamic systems with known control inputs and subjected to process and measurement noise with known statistics. Results of the algorithm include estimates of the parameters and smoothed estimates of the state and process noise sequences. The problem is stated as the minimization of a quadratic performance index. This minimization problem is then converted to a nonlinear programming problem for determining the optimum parameter estimates. A step in the nonlinear programming procedure involves the solution of a linear two point boundary value problem (TPBVP). The smoothed state and process noise estimates result from the boundary value problem. Two methods are presented for solving the TPBVP. The Smoothing-Riccati Equation (or successive sweep) method requires solution of a matrix Riccati equation. A modified Newton's method is used to solve the nonlinear programming problem. After solving TPBVP, the gradient of the performance index with respect to the parameters is calculated. Dissert. Abstr.

N79-29825 Mississippi State Univ., State College.
A HYBRID DECODER FOR COMPOUND CHANNELS Ph.D. Thesis
Chung-Dau Mo 1978 185 p
Avail: Univ. Microfilms Order No. 7918535

An algorithm whose performance approaches that of the optimal maximum likelihood Viterbi decoder in dealing with random errors and processes a burst-error-correcting capability close to that of the optimal B2 decoders was examined. The algorithm developed uses a syndrome detecting logic to direct two decoders; Viterbi and algebraic, to assume the decoding load alternatively, depending on the channel characteristics at the moment. The hybrid system outperformed both the algebraic and the Viterbi decoders in every case, except the 1 percent random error channel where the Viterbi decoder had one bit less decoding error. Dissert. Abstr.

N79-29826 Stanford Univ., Calif.
THE INTERACTION OF OBSERVATION AND INFERENCE Ph.D. Thesis
Robert Elliot Filman 1979 369 p
Avail: Univ. Microfilms Order No. 7917228

The problem of formalizing the expression and solution of reasoning problems in a machine manipulable form is addressed by analyzing the interaction of the standard form of deductive steps with an observational analogy obtained by performing computation in a semantic model. A formalization is embodied in its axioms, and emphasis is given to both axiomatizing the rules of chess, and discussing and comparing the representational decisions involved in that axiomatization. Consideration is given to not only the necessity for these particular choices (and possible alternatives) but also the implications of these results for designers of representational systems for other domains. Using a reasoning system for first order logic, FOL, a detailed proof of the solution of a difficult retrograde chess puzzle is constructed. The close correspondence between this 'formal' solution to the problem, and an 'informal' descriptive analysis a human might present is shown. Dissert. Abstr.

N79-29827 Virginia Univ., Charlottesville.
CHARACTERISTICS OF PROGRAM LOCALITIES IN ALGOL-60 PROGRAMS Ph.D. Thesis
Alan Wayne Madison 1978 202 p
Avail: Univ. Microfilms Order No. 7916312

The precise definition of an interval of localized reference behavior, the bounded locality, is presented. The bounded locality interval precisely identified the start and end of an interval of localized reference behavior and may be used, therefore, for the accurate measurement of the properties of locality of reference in actual programs. Measurements were made of the bounded locality intervals found in a sample of Algol-60 programs. The characteristics of the hierarchy of bounded locality intervals are presented and discussed. Methods are described for extracting a linear sequence of phases from the hierarchy of bounded locality

intervals. These methods are applied to the sample of Algol-60 programs. The results are discussed in terms of their implications for the modeling of program behavior and for the design and analysis of memory management policies for virtual memory systems. S.E.S.

N79-29828 Minnesota Univ., Minneapolis.
ZERO-ONE MIXED INTEGER PROGRAMMING USING INTERACTIVE GRAPHICS, VOLUMES 1 AND 2 Ph.D. Thesis
Edward Huffaker McCall 1979 482 p
Avail: Univ. Microfilms Order No. 7918369

A method to accelerate finding feasible solutions for the zero-one mixed integer programming (MIP) problem, and provides experimental results using that method is described. This method is based on the following postulated property of zero-one integer variables: that during the MIP optimization some of those variables will tak values that cluster towards or around a feasible mixed integer (MI) solution zero or one value. The results show that both postulates were generally true for the problems tested. This appears to be the first time those postulates stated. It was also postulated that certain MIP optimization calculation data which is ignored for predictive purposes in most MIP codes would be useful for predictive purposes in this method. Dissert. Abstr.

N79-29829 Stanford Univ., Calif.
VERSION SPACES: AN APPROACH TO CONCEPT LEARNING Ph.D. Thesis
Tom Michael Mitchell 1979 215 p
Avail: Univ. Microfilms Order No. 7917262

A method for forming general descriptions of concepts from a sequence of positive and negative training instances is presented. A predetermined space or language of possible concept descriptions, finding those which are consistent with the observed training instances was examined. The subspace (version space) of all plausible concept descriptions is represented and updated with each training instance. The information available from the training instances concerning the identity of the concept to be learned is summarized. Version spaces are used for making reliable classifications based upon partially learned concepts, and for proposing informative new training instances to direct further learning. Proofs are given for the correctness of the method for representing version spaces, and of the associated concept learning algorithm. Dissert. Abstr.

N79-29830 Virginia Univ., Charlottesville.
STATISTICAL MEASURES OF PROGRAM PERFORMANCE WITH APPLICATIONS TO ALGORITHMS FOR THE LONGEST CYCLE PROBLEM Ph.D. Thesis
Carroll Walton Morrow, Jr. 1978 229 p
Avail: Univ. Microfilms Order No. 7916299

The feasibility of using statistical analysis as a practical alternative to a deterministic or probabilistic analysis of the expected performance of complex algorithms was examined. Several algorithms for the problem of finding the longest simple cycle in an arbitrary graph were chosen. Included among the algorithms are a branch-and-bound procedure, original heuristics, and an original worst case polynomial algorithm for the restriction of the problem to a particular class of graphs, the tournaments. A variety of random variables, such as run time, number of program statements executed, and length of the longest cycle, are analyzed. Pictorial representations of the distributions, as well as definitive estimates of location and dispersion, are given. It is shown that variables other than program run time can serve as reliable measures of execution speed. Regression techniques are used to determine statistically the degree of polynomial expected performance exhibited by some of the algorithms. Dissert. Abstr.

N79-29831 State Univ. of New York at Buffalo.
COMPUTERIZED RECONSTRUCTION OF IMAGES FROM PROJECTIONS BASED ON RADON'S INVERSION FORMULA Ph.D. Thesis
Stuart William Rowland 1979 473 p
Avail: Univ. Microfilms Order No. 7913921

The values of the function along all lines in the phone are estimated at given points from a partial knowledge of its Radon transform. The discrete approximations to continous operations are introduced along with the discrete versions of the reconstruction formulas. Each approximationused is rigorously justified. The discrete formulas produced contains two unspecified functions: a filtering function and an interpolating function. The choice of these functions is the fundamental difference between the methods presented. An experimental investigation algorithm using four tests is presented. These include the determination of the full width at half maximum and maximum secondary overshoot parameters obtained from reconstructing a point object, the sensitivity of the algorithms to noise, the ability to reconstruct a band limited phantom and the reconstruction of a complicated object repsresenting a cross ection of a head. Dissert. Abstr.

N79-29832*# Lockheed Missiles and Space Co., Huntsville, Ala. Research and Engineering Center.
CELFE: COUPLED EULERIAN-LAGRANGIAN FINITE ELEMENT PROGRAM FOR HIGH VELOCITY IMPACT. PART 1: THEORY AND FORMULATION Final Report, Jun. 1975 - Sep. 1977
C. H. Lee Jan. 1978 168 p
(Contract NAS3-18908)
(NASA-CR-159395; LMSC-HREC-TR-D497204-Pt-1) Avail: NTIS HC A08/MF A01 CSCL 09B

A 3-D finite element program capable of simulating the dynamic behavior in the vicinity of the impact point, together with predicting the dynamic response in the remaining part of the structural component subjected to high velocity impact is discussed. The finite algorithm is formulated in a general moving coordinate system. In the vicinity of the impact point contained by a moving failure front, the relative velocity of the coordinate system will approach the material particle velocity. The dynamic behavior inside the region is described by Eulerian formulation based on a hydroelasto-viscoplastic model. The failure front which can be regarded as the boundary of the impact zone is described by a transition layer. The layer changes the representation from the Eulerian mode to the Lagrangian mode outside the failure front by varying the relative velocity of the coordinate system to zero. The dynamic response in the remaining part of the structure described by the Lagrangian formulation is treated using advanced structural analysis. An interfacing algorithm for coupling CELFE with NASTRAN is constructed to provide computational capabilities for large structures. A.R.H.

N79-29833*# Lockheed Missiles and Space Co., Huntsville, Ala. Research and Engineering Center.
CELFE: COUPLED EULERIAN-LAGRANGIAN FINITE ELEMENT PROGRAM FOR HIGH VELOCITY IMPACT. PART 2: PROGRAM USER'S MANUAL Final Report, Jun. 1975 - Sep. 1977
C. H. Lee Jan. 1978 270 p
(Contract NAS3-18908)
(NASA-CR-159396; LMSC-HREC-TR-D497204-Pt-2) Avail: NTIS HC A12/MF A01 CSCL 09B

The CELFE computer program and user's manual, together with the execution of the CELFE/NASTRAN system, are described. The execution procedure and the transfer of data between the CELFE and NASTRAN programs are controlled through the use of DATA files in the Univac 1100 system. Five data files are used to control the runstream and data transfer, and three files are used to hold the programs. These files are contained on a single tape. Changes in NASTRAN routines required by the present analysis are also discussed in this report. All the program listings, except the last two files (where the absolute and relocatable elements are stored), are included in the appendixes. Author

N79-29834# Computer Sciences Corp., Silver Spring, Md. System Sciences Div.
CENTRAL FLOW CONTROL SYSTEM DATA ASSEMBLER COMPONENT USER'S MANUAL Final Report
Jan. 1979 110 p refs
(Contract DOT-FA77WA-3955)
(AD-A069837; CSC/SD-78/6141; FAA-RD-79-36) Avail: NTIS HC A06/MF A01 CSCL 09/2

The data assembler (DA), which creates, updates, merges, or lists the central flow control data base, is an off-line program, and operates on air-carrier flight schedules, airport data, airline codes, aircraft data, ARTCC data, zone date, and general-aviation

data. The primary inputs to DA are Official Airline Guide data. Processing is controlled by user option specification and DA validates all input data and provides its own internal housekeeping facilities. Procedures for exercising these functions are described. A.R.H.

N79-29835# Computer Sciences Corp., Silver Spring, Md. System Sciences Div.
CENTRAL FLOW CONTROL TEST CASE GENERATOR/ON-LINE TEST DIRECTOR COMPONENTS USER'S MANUAL Final Report
Jan. 1979 50 p refs
(Contract DOT-FA77WA-3955)
(AD-A069847; CSC/SD-78/6138; FAA-RD-79-39) Avail: NTIS HC A03/MF A01 CSCL 09/2

The test case generator and the on-line test director support test execution of the central flow control operational complex applications programs by providing simulated message input facilities. Procedures are described for exercising the simulation capability which enables evaluation of the message processing programs in a controlled environment without requiring actual data, flight plans, communications, or data-entry personnel. A.R.H.

N79-29836# Computer Sciences Corp., Silver Spring, Md. System Sciences Div.
CENTRAL FLOW CONTROL OPERATIONAL SUPPORT SYSTEM USER'S MANUAL TIMING ANALYSIS REPORT PROGRAM (TARP) Final Report
Jan. 1979 49 p refs
(Contract DOT-FA77WA-3955)
(AD-A069812; CSC/SD-78/6155; FAA-RD-79-41) Avail: NTIS HC A03/MF A01 CSCL 09/2

The functions of the timing analysis report program (TARP) and the procedures required to exercise them are described. Modifications to the TARP program were made for compatibility with OS/MVT. The program reduces system analysis recording (SAR) data and produces timing and summary information reports regarding system use. Multiple SAR inputs, time intervals, subprogram requests, and phase combinations are accommodated. A.R.H.

N79-29837# Computer Sciences Corp., Silver Spring, Md. System Sciences Div.
CENTRAL FLOW CONTROL OPERATIONAL SUPPORT SYSTEM USER'S MANUAL HRT REDUCTION PROGRAM (REDUC) Final Report
Jan. 1979 57 p refs
(Contract DOT-FA77WA-3955)
(AD-A069813; CSC/SD-78/6154; FAA-RD-79-42) Avail: NTIS HC A04/MF A01 CSCL 09/2

The functions of the High Resolution Timer (HRT) Reduction Program (REDUC) are described. The procedures required to exercise them are discussed for the Central Flow Control (CFC) facility. REDUC reduced data relevant to the internal operation of the CFC monitor, including Compute Element time used for: (1) 1/0 interrupts; (2) external interrupts; (3) timer interrupts; and (4) supervisor service calls. Frequently used programs and facilities are identified, and the basis for system tuning operations is provided. S.E.S.

N79-29838# Computer Sciences Corp., Silver Spring, Md. System Sciences Div.
CENTRAL FLOW CONTROL PRECEDENCE NETWORK USER'S MANUAL Final Report
Jan. 1979 44 p refs
(Contract DOT-FA77WA-3955)
(AD-A069814; CSC/SD-78/6165; FAA-RD-79-43) Avail: NTIS HC A03/MF A01 CSCL 09/2

The functions of the precedence network (PN) program, an activity-oriented planning tool which provides critical-path-method (CPM), or PERT-like, estimation of project completion and identifies probable trouble areas are desribed. Outputs include time-ordered task listings, Gantt charts, weekly task status reports, and actual-vs.-estimated cumulative task completions. A.R.H.

N79-29839*# Virginia Polytechnic Inst. and State Univ., Blacksburg.
RESEARCH ON AN AUGMENTED LAGRANGIAN PENALTY FUNCTION ALGORITHM FOR NONLINEAR PROGRAMMING Final Report, Apr. - Dec. 1978
Les Frair Dec. 1978 79 p refs
(Grant NsG-1525)
(NASA-CR-158391) Avail: NTIS HC A05/MF A01 CSCL 09B

The augmented Lagrangian (ALAG) Penalty Function Algorithm for optimizing nonlinear mathematical models is discussed. The mathematical models of interest are deterministic in nature and finite dimensional optimization is assumed. A detailed review of penalty function techniques in general and the ALAG technique in particular is presented. Numerical experiments are conducted utilizing a number of nonlinear optimization problems to identify an efficient ALAG Penalty Function Technique for computer implementation. K.L.

N79-29840# Aeronautical Research Labs., Melbourne (Australia).
GRADIENT OPTIMIZATION ALGORITHMS FOR SYSTEMS WITH TERMINAL CONSTRAINTS
Ronald B. Zmood Aug. 1978 20 p refs
(ARL/Sys-Note-58; AR-001-297) Avail: NTIS HC A02/MF A01

The application of optimization techniques to the derivation of predictive information for flight displays was investigated in connection with operational situations involving large disturbances and maneuvers. Current gradient methods for computing extermal solutions of optimal control problems for systems having boundary conditions but without state or control constraints were surveyed. Results indicate that a two stage procedure is required, with the first stage using a first order gradient, while the second stage would use a higher order variable metric method. Proposals are advanced for further research on optimization algorithms. S.E.S.

N79-29841# Stanford Univ., Calif. Dept. of Physics.
A SURVEY OF THE STATE OF SOFTWARE FOR PARTIAL DIFFERENTIAL EQUATIONS
Roland A. Sweet (Colo. Univ. at Denver) Jan. 1979 34 p refs Presented at the Tex. Conf. on Math. Software, Austin, 29 - 31 Mar. 1978
(Contract DAAG79-77-G-0029)
(AD-A068232; SU-STAN-CS-79-704) Avail: NTIS HC A03/MF A01 CSCL 12/1

This paper surveys the state of general purpose software for the solution of partial differential equations. A discussion of the purported capabilities of twenty-one programs is presented. No testing of the routines was performed. GRA

N79-29842# Harvard Univ., Cambridge, Mass. Computation Lab.
STUDIES ON THE FEASIBILITY OF SYSTEM SOFTWARE DEBUGGING Final Technical Report, Jun. 1977 - Oct. 1978
Rajendra K. Jain and Ugo Gagliardi Apr. 1979 227 p refs
(Contract F30602-77-C-0058; AF Proj. 5581)
(AD-A069028; RADC-TR-79-20) Avail: NTIS HC A11/MF A01 CSCL 09/2

This report is two separate but parallel efforts on system software debugging studies. The first study describes a theoretical approach on defining new resources management algorithms that can be utilized in an operating system. The second report describes an experimental work station for performing sophisticated operating system software debugging. The actual experimentation is performed by connecting a PDP 11/40 to a PDP-10 through a high speed data bus and installing on the PDP 11/40 a virtual machine monitor. GRA

N79-29843# Naval Postgraduate School, Monterey, Calif.
NAVAL APPLICATIONS: TEN ALOGRITHMS FOR THE HEWLETT-PACKARD HP-67 AND HP-97 CALCULATORS Technical Report, Oct. - Dec. 1978
R. H. Shuddle Feb. 1979 162 p refs
(AD-A068633; NPS55-79-04) Avail: NTIS HC A08/MF A01 CSCL 09/2

Ten algorithms pertaining to underwater acoustics target motion analysis, P-3 mission planning, flight crew management, and naval gunfire support conversion are presented along with

programs for Hewlett-Packard HP-67 and HP-97 programmable calculators. GRA

N79-29844# University of Southern California, Los Angeles. Dept. of Finance and Business Economics.
EFFICIENT FRONTIERS FOR NONLINEAR MULTIDIMENSIONAL KNAPSACK PROBLEMS
Jonathan S. Yormark Jan. 1979 26 p refs
(Contract N00014-75-C-0733)
(AD-A068390; USC-WP-2) Avail: NTIS HC A03/MF A01 CSCL 12/2

An efficient recursive enumeration procedure is described for finding the complete family of efficient, or undominated, solutions for general separable multidimensional 'knapsack' problems. A generalization of the Gilmore-Gomory procedure provides an alternative view of the Morin-Marsten method that admits an algorithm requiring significantly less computer storage and computational overhead. We illustrate the procedure with a highly nonlinear example. GRA

N79-29845# Naval Research Lab., Washington, D. C.
EDIT: A FORTRAN PROGRAM MAINTENANCE SYSTEM FOR THE TEXAS INSTRUMENTS ASC-7
Paul Morawski 16 Apr. 1979 17 p ref Supersedes DTNSRDC/CMLD-77/07
(AD-A068362; NRL-MR-3978; DTNSRDC/CMLD-77/07) Avail: NTIS HC A02/MF A01 CSCL 09/2

EDIT is a MACRO program for automatic maintenance of FORTRAN and RATFOR (RATional FORTRAN) programs on the Texas Instruments Advanced Scientific Computer. It has been used extensively to accelerate the creation of complex fluid dynamics programs for execution on the Advanced Scientific Computer (ASC). EDIT allows the user to more efficiently create and modify programs using the TI-supplied Source Management System, SMS. Object libraries and load modules may also be automatically updated. The program files (source, object, and load module) may be tape or disk resident and will always have a user-specified number of versions retained as backup. The EDIT system is described and sample usages are presented. GRA

N79-29846# University of Southern California, Los Angeles. Image Processing Inst.
IMAGE UNDERSTANDING RESEARCH Semiannual Technical Report, 1 Oct. 1978 - 31 Mar. 1979
Harry C. Andrews and William K. Pratt 31 Mar. 1979 224 p refs
(Contract F33615-76-C-1203; ARPA Order 3119)
(AD-A068234; USCIPI-860) Avail: NTIS HC A10/MF A01 CSCL 09/4

This technical report summarizes the image understanding, image processing, and smart sensor research activities performed by the USC Image Processing Institute. The research program has, as its primary purpose, the development of techniques and systems for understanding images. Methodologies range from low level image processing principles, smart sensor CCD LSI circuit design, up to higher level symbolic representations and relational structure manipulations. GRA

N79-29847# Los Alamos Scientific Lab., N. Mex.
K-FIX: A COMPUTER PROGRAM FOR TRANSIENT, TWO-DIMENSIONAL, TWO-FLUID FLOW. THREED: AN EXTENSION OF THE K-FIX CODE FOR THREE-DIMENSIONAL CALCULATIONS
W. C. Rivard and M. D. Torrey Oct. 1978 143 p refs
(Contract W-7405-eng-36)
(LA-NUREG-6623-Suppl-2) Avail: NTIS HC A07/MF A01

The transient, two dimensional, two fluid code K-FIX was extended to perform three dimensional calculations. This capability was achieved by adding five modification sets of FORTRAN statements to the basic two dimensional code. The modifications are listed and described, and a complete listing of the three dimensional code is provided. DOE

N79-29848# Department of Energy, Washington, D. C. Energy Information Administration.
PRIMER AND USER MANUAL FOR A FORTRAN LANGUAGE INTERACTIVE PROCESSOR (FLIP)
H. J. Greenburg Mar. 1979 54 p refs
(DOE/EIA-0103/25) Avail: NTIS HC A04/MF A01

A FORTRAN Language Interactive Processor (FLIP) as a precursor for validation software under development, which will provide a capability for interactive diagnostic analysis of matricial models. The routines are coded in FORTRAN for IBM's G-compiler and to provide a skeleton interactive system with complete user interface that enables a system designer to have a ready-made front end for an interactive system. Author (DOE)

N79-29849# Oak Ridge Gaseous Diffusion Plant, Tenn.
ECHO: A SIMPLE PROCEDURE TO ECHO INPUT DATA FROM ANY EXISTING FORTRAN CODE
O. W. Russ, Jr. Jan. 1979 23 p refs
(Contract W-7405-eng-26)
(K/CSD/TM-27) Avail: NTIS HC A02/MF A01

A procedure by which an exact copy of input data to a FORTRAN program can be listed by inserting a single statement. CALL ECHO, and just a few Job Control Language statements, without any further changes to the program itself is described. This allows the card images to be displayed such that the card columns and card sequence order can be easily checked for accuracy. These features are of great importance in computer codes requiring large numbers of input cards having data in specific columns or fields and in a particular input stream sequence. By such display of the input data, program statements can concentrate on the presentation of the input data in a meaningful manner rather than just as a check on their accuracy. Also, these data are presented at the beginning of the program; in this way problems of the data remaining in buffers and not being printed out are avoided, as well as those associated with ABENDS caused by the input data themselves. DOE

N79-29850# Research Inst. of National Defence, Stockholm (Sweden).
USER MANUAL FOR AUTODOK: A COMPUTER PROGRAM FOR ANALYSIS OF FORTRAN ROUTINES ON AN IBM 370 [ANVAENDARHANDLEDNING TILL AUTODOK, ETT DATORPROGRAM FOER ANALYS AV FORTRAN-RUTINER PAA IBM 370]
Gunnar Holm Jun. 1978 33 p In SWEDISH
(FOA-C-20246-D8(D4,E1)) Avail: NTIS HC A03/MF A01

The AUTODOK program analyses FORTRAN routines written for the IBM 370, supplementing the information so acquired with certain information from print-outs of the H extended-compiler. The result is a list of all the quantities contained in the routine with all their attributes. The user has the freedom to choose which tables he wishes to be printed-out and in what order, and to supply them with a textural commentary. In addition there is a facility for incorporating one's own routines which take account of information from the commentary card. A.R.H.

N79-29851# Research Inst. of National Defence, Stockholm (Sweden).
TOREZ: A COMPUTER PROGRAM FOR RESHAPING LAGRANGE SQUARE GRIDS [TOREZ: DATAMASKINPROGRAM FOER OMZONING AN LAGRANGE-RUNTNAET]
Sven-Olof Staahl Nov. 1978 39 p refs In SWAHILI
(FOA-C-20279-D4) Avail: NTIS HC A03/MF A01

TOREZ, a FORTRAN auxiliary program for the computer program TODEP used to solve the two dimensional wave propagation and deformation problem, is described. The TOREZ program permits reshaping of the square grids of a TODEP program so that mass, momentum, and energy are conserved. Author (ESA)

N79-29852# Bosch (Robert) G.m.b.H., Darmstadt (West Germany). Geschaeftsbereich Fernsehanlagen.
MODULAR SYSTEM FOR PHOTOMETRIC AND MORPHOLOGICAL ANALYSIS OF MICRO AND MACROSCOPIC IMAGES APPLYING VIDEO TECHNIQUES (COMPUTERIZED GEOMETRICAL DISPLAY) Final Report
Gerhard Kamin Bonn Bundesmin. fuer Forsch. U. Technol. Dec. 1977 98 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin fuer Forsch. U. Technol.
(BMFT-FB-T-77-80) Avail: NTIS HC A05/MF A01; ZLDI, Munich DM 20,35

An image analyzer was developed based on a mathematical

theory for the quantitative determination of n-dimensional and especially two-dimensional structures. This image analyzer, also designated as a geometry computer, is essentially characterized by geometrical operations performed on a mathematically coherent basis (two-dimensional image transformations with respect to so-called structural elements). These operations establish an exactly defined functional relationship between input and resultant picture elements. The geometry computer is being used for image analysis in the fields of metallography, microbiology, medicine, and human genetics. Author (ESA)

N79-29853# Hawaii Univ., Honolulu. Water Resources Research Center.
A PRINT-PLOT DISPLAY SYSTEM FOR A LINEAR PROGRAMMING-BASED RESOURCES PLANNING MODEL Technical Report, 1 Oct. 1977 - 30 Sep. 1978
Tung Liang and Ping-Sun Leung Nov. 1978 59 p refs
(Contract DI-14-34-0001-8013)
(PB-294418/9; TM-59; W79-05797; OWRT-B-053-HI(1)) Avail: NTIS HC A04/MF A01 CSCL 09B

The creation of an efficient input data basis for fast retrieval and display to speed up the planning process is developed. The iterative process generates a large volume of output which must be quickly displayed, a fact which requires a fast display system. A printplot display system for both inputs and outputs was developed to improve the planning process based on the resource model developed earlier by Liang. GRA

62 COMPUTER SYSTEMS

Includes computer networks.

N79-29854 Purdue Univ., Lafayette, Ind.
ON THE MODELING OF RESOURCE DEMANDS IN A MULTIPROGRAMMED COMPUTER SYSTEM Ph.D. Thesis
Robert Louis Mead 1978 234 p
Avail: Univ. Microfilms Order No. 7914929

A methodology for deriving and evaluating workload representations used to drive simulation models of computer systems is presented. The methodology uses the output of a trace-driven simulation model driven by a detailed workload representation as a basis for comparison. The detailed representation consists of a collection of job scripts, where every job in the workload is represented by a separate job script. The job script describes a job at the level of CPU and I/O device usage. Less detailed representations, called reduced representations, are constructed from the job scripts, and can be evaluated using the methodology. An empirical study of three reduced representations is presented as an example using the methodology. The importance of various features of the reduced representations, such as the number of job classes used to represent the entire workload and the type of distribution used to describe resource service times is assessed. Dissert. Abstr.

N79-29855 Ohio State Univ., Columbus.
A GRAPH-THEORETIC APPROACH TO OPTIMAL FILE ALLOCATION IN DISTRIBUTED COMPUTER NETWORKS Ph.D. Thesis
K. S. Natarajan 1979 162 p
Avail: Univ. Microfilms Order No. 7916009

An optimal file allocation problem can be viewed as an optimal allocation problem on an appropriately defined weighted network. An efficient two phase algorithm was developed to solve the optimal allocation problem in weighted tree networks. The algorithm, which takes advantage of the acyclic structure of a tree network, has time and space requirements that are both linear in N, the number of nodes in the network, and hence is an asymptotically optimal algorithm. A heuristic decomposition approach is proposed for such networks. The allocation problem in a general network is decomposed into a sequence of allocation problems in tree networks. Optimal file allocations are determined in tree networks and subsequently modified to obtain optimal or near-optimal file allocations in the general network. Dissert. Abstr.

N79-29856 Illinois Inst. of Tech., Chicago.
PROGRAM PARTITIONING AND LOAD BALANCING IN NETWORK COMPUTERS Ph.D. Thesis
Ossama Ibrahim El-Dessouki 1978 209 p
Avail: Univ. Microfilms Order No. 7913093

A three-fold classification scheme for the partitioning problem is presented. The theoretical complexity of each category is analyzed using the theory of NP-complete problems. An efficient O of n square and optimal algorithm is developed for partitioning totally ordered computational tasks. The development of a partitioning scheme based on branch and bound technique is presented. The developed scheme is characterized by the adaptability of its accuracy, speed, and efficiency to user needs. The scheme is transformed into a distributed form suitable for implementation on a network computer. The topic of program representation is discussed. Methods for representing various forms of flow of control and data dependency in programs are developed. Dissert. Abstr.

N79-29857 Stanford Univ., Calif.
THINGLAB: A CONSTRAINT-ORIENTED SIMULATION LABORATORY Ph.D. Thesis
Alan Hamilton Borning 1979 107 p
Avail: Univ. Microfilms Order No. 7917213

The design and construction of a computer based simulation laboratory is described. The laboratory provides an environment for constructing dynamic models of experiments in geometry and physics, such as simulations of constrained geometric objects, simple electrical circuits, mechanical linkages, and bridges under load. Using the techniques developed for these domains, the system is used to model other sorts of objects, such as a graphical calculator, and documents with constraints on their layout and contents. Part-whole and inheritance hierarchies are used to describe the structure of a simulation. Constraints are employed as a way of describing the relations among the parts of a simulation. Constraints are a particularly important tool for dealing with complexity, because they allow the user to specify all the relations to be maintained independently of one another, leaving it up to the system to plan exactly how the constraints are to be satisfied. ThingLab is implemented in the Smalltalk-76 programming language, and runs on a personal computer. Dissert. Abstr.

N79-29858# University of Southern California, Marina del Rey. Information Sciences Inst.
THE JOY OF TENEX AND TOPS-20, PART 2
Chloe Sommers Holg Jan. 1979 113 p
(Contract DAHC15-72-C-0308; ARPA Order 2223)
(AD-A069588; ISI/TM-79-16-Pt-2) Avail: NTIS HC A06/MF A01 CSCL 17/2

This is a basic manual discussing the operation of the ARPANET, the TENEX and TOPS-20 operating systems, and the following programs: XED, TECO, DCOPY, XOFF, RUNFIL, FTP, TELNET, and RSEXEC. GRA

N79-29859# University of Southern California, Marina del Rey. Information Sciences Inst.
THE JOY OF TENEX AND TOPS-20, PART 1
Chloe Holg Mar. 1979 126 p
(Contract DAHC15-72-C-0308; ARPA Order 2223)
(AD-A069518; ISI/TM-79-15-Pt-1) Avail: NTIS HC A07/MF A01 CSCL 17/2

This is a basic manual discussing the operation of the ARPANET, the TENEX and TOPS-20 operating systems, and the following mail handling programs: SNDMSG, MSG, Hermes, and MAIL GRA

N79-29860# Illinois Univ., Urbana. Dept. of Computer Science.
SIMULATION OF CONTINUOUS NETWORKS WITH MODEL
Mitchell G. Roth and T. F. Runge Dec. 1978 165 p refs
(Contract EY-76-S-02-2383)
(COO-2383-0047; UILU-ENG-78-1743; UIUCDCS-R-78-921) Avail: NTIS HC A08/MF A01

This manual is intended for the student, scientist, or engineer whose interests involve the solution of ordinary differential equations. In many cases, such equations arise in

connection with the development of computer simulation models. MODEL (Modular Ordinary Differential Equation Language) is a very general and easy-to-use package for the formulation and simulation of continuous system models based on ordinary differential and nondifferential equations ad generalized network (i.e., connective) effects. Partial differential equations are handled when they are transformed to a system of ODEs by the finite element method or the method of lines. MODEL combines both equation oriented and network oriented modeling features with a stiffly stable implicit integration method; this approach allows it to be applied more widely and easily than any other continuous simulation package. DOE

N79-29861# Research Inst. of National Defence, Stockholm (Sweden).
ESTABLISHING A USER DIALOGUE WITH AN INTERACTIVE COMPUTER SYSTEM (DAPU) [UTFORMNING AV ANVAENDARDIALOG I ETT INTERAKTIVIT DATORSYSTEM (DAPU)]
Lars-Aake Larsson Feb. 1979 18 p In SWAHILI
(FOA-C-20289-M6) Avail: NTIS HC A02/MF A01

A computer system designed to assist in planning budgeting, and coordination among the various branches of the Swedish defense system is described. It is designed to be accessible by even an inexperienced user who, by addressing the system through one of its interconnected telephone terminals, can receive instructions directly from the computer on its use. The user chooses from among a set of alternative functions presented by the computer and thus establishes his specific program needs vis-a-vis a man machine dialog. Author. (ESA)

63 CYBERNETICS

Includes feedback and control theory.
For related information see also *54 Man/System Technology and Life Support*.

N79-29862 Arizona Univ., Tucson.
DECOUPLING AND REDUCED ORDER MODELING OF TWO-TIME-SCALE CONTROL SYSTEMS Ph.D. Thesis
Leonard Robert Anderson 1979 136 p
Avail: Univ. Microfilms Order No. 7914436

Analytical findings and a computational method for time-scale decoupling and order reduction of linear control systems are presented. A transformation of variables is considered which reduces the system to block-diagonal form with slow and fast modes decoupled. Once the decoupled form of the system is obtained, a small parameter can be identified which provides a measure of the system's time scale separation, and the methods of singular perturbations can be applied to yield reduced-order approximations of the original system. A particular reduced-order model so obtained overcomes certain difficulties encountered with other well known order-reduction methodologies. Dissert. Abstr.

N79-29863 Washington Univ., Seattle.
STATE CONTROLLABILITY AND OBSERVABILITY FOR LINEAR NEUTRAL SYSTEMS Ph.D. Thesis
Daniel Anthony OConnor 1978 199 p
Avail: Univ. Microfilms Order No. 7915060

The construction of an equation which describes the evolution of the state of linear neutral systems with and without delays in control is discussed. It is shown that the state evolution process can be modelled as an abstract boundary control problem in function space. This problem is solved to give an integral representation of the state. Next the approximate state controllability problem is considered. Necessary and sufficient conditions for approximate controllability are obtained using the integral representation of the state. It is shown that these conditions lead to criteria for exact controllability, spectral controllability and euclidean controllability. The problem of state observability is considered and abstract necessary and sufficient conditions for observability are obtained. These conditions are shown to be dual to a set of controllability conditions. Dissert. Abstr.

N79-29864 Michigan State Univ., East Lansing.
CLUSTER VALIDITY AND INTRINSIC DIMENSIONALITY Ph.D. Thesis
Thomas Anderson Bailey, Jr. 1978 140 p
Avail: Univ. Microfilms Order No. 7917673

A random-graph-based technique for validating clusters, called the cluster profile, is developed and analyzed. Indices of cluster compactness and isolation are defined, and measures of validity are developed from probability distributions of the indices over sample populations selected from subsets of nodes in random graphs. The measures are inexpensive to calculate and are applied to any subset of nodes, whether discovered by clustering methods or defined a priori. The measures are used to judge the validity of arbitrary clusters and are not limited to clusters found by a specific clustering method. The extent to which techniques for judging cluster validity based on random graph theory are applicable to data sets produced under an alternative random model was studied. Dissert. Abstr.

N79-29865 Oregon State Univ., Corvallis.
THE AUTOMATED INFERENCE OF TREE SYSTEMS Ph.D. Thesis
Barry Arthur Levine 1979 201 p
Avail: Univ. Microfilms Order No. 7917999

Tree systems are used in syntactic pattern recognition for describing two-dimensional patterns. Results on tree automata are extended with the introduction of the subtree-invariant equivalence relation R. R relates two trees when the appearance of one implies the appearance of the other in similar trees. A new state minimizing algorithm for tree automata is formed using R. A bound for Brainerd's minimization method is determined. The group unordered tree automaton (GUTA) is introduced which accepts all orientations of open-line patterns described using directed arc primitives. The specification of a GUTA includes an unordered tree automaton M, which only accepts a standard orientation of a given class of open-line pictures, and a transformation group, which describes how the primitives transform under rotational shifts. The GUTA performs all orientational parses in parallel, reports all successful transformations and operates in the same time complexity as M. The GUTA is much easier to specify than the equivalent nondecomposed unordered tree automaton. Dissert. Abstr.

N79-29866# Syracuse Univ., N. Y. School of Computer and Information Science.
A DYNAMIC PRIORITY SCHEDULING RULE WITH OPTIMIZATION FOR TRANSACTION PROCESSING SYSTEMS Interim Report, Oct. 1977 - Oct. 1978
Daniel K. Wood Griffiss AFB, N.Y. RADC Feb. 1979 167 p refs
(Contract F30602-77-C-0235; AF Proj. 5581)
(AD-A068160; RADC-TR-79-8) Avail: NTIS HC A08/MF A01 CSCL 12/1

This report describes the investigation of a dynamic priority scheduling rule and its applicability for scheduling transaction processing systems. In this report once the scheduling rule was chosen, various cost models were optimized using this rule. Simulation studies were also conducted using this rule. The results from this analysis indicates that this scheduling rule can be applied favorably to transaction processing systems. GRA

N79-29867# Science Applications, Inc., Arlington, Va.
IMAGE UNDERSTANDING Semiannual Technical Report, Nov. 1978 - Apr. 1979
Lee S. Baumann, ed. Apr. 1979 191 p refs Workshop held at Palo Alto, Calif., 24-25 Apr. 1979
(Contract MDA903-78-C-0095)
(AD-A069515; SAI-80-895-WA) Avail: NTIS HC A09/MF A01 CSCL 09/4

This document contains the technical papers and outlines of semi-annual progress reports presented by the research activities in Image Understanding sponsored by the Information Processing Techniques Office; Defense Advanced Research Projects Agency. The papers were presented at a workshop conducted on 24-25 April 1979 in Palo Alto, California. GRA

N79-29868# Yale Univ., New Haven, Conn. Systems and Information Sciences.

STABLE ADAPTIVE CONTROLLER DESIGN. PART 2: PROOF OF STABILITY
Kumpati S. Narendra, Yuan-Hao Lin, and Lena S. Valavani Apr. 1979 28 p refs
(Contract N00014-76-C-0017)
(AD-A069179; S/IS-7904-Pt-2) Avail: NTIS HC A03/MF A01 CSCL 12/1

This paper presents a proof of the stability in the large of an adaptive system which is a modification of that originally suggested by Monopoli and later refined by Narendra and Valavani. The proof of stability applies to both continuous and discrete systems. The stability problem was clearly defined and a conjecture was made that the plant together with the controller would be stable if the augmented error is bounded. Recently, while applying the same approach to discrete systems a new error model based on the third prototype was suggested. This model contains an additional feedback term similar to that found in much of the adaptive observer literature and is particularly useful in proving the stability in the large of discrete adaptive systems. The successful resolution of the latter problem provides the motivation for using a similar model in the continuous case as well. GRA

N79-29869# Centre de Recherches Scientifiques et Techniques de l'Industrie des Fabrications Metalliques, Brussels (Belgium). Sect. Construction Mecanique.
COMPARATIVE STUDY OF THE OPERATING ECONOMY OF PROGRAMMABLE SYSTEMS FOR NUMERICALLY CONTROLLED MACHINE TOOLS. APPLICATIONS TO LATHE WORK [ETUDE COMPARATIVE DE RENTABILITE DES SYSTEMES DE PROGRAMMATION DES MACHINES-OUTILS A COMMANDE NUMERIQUE. APPLICATION AU CAS DU TOURNAGE]
Luc Soete and Jos Pinte May 1978 109 p refs In FRENCH Sponsored by Inst. de Rech. Sci. pour l'Ind. et l'Agr.
(CRIF-MC-66) Avail: NTIS HC A06/MF A01

A comparison of seven computer assisted programming systems for numerically controlled lathes was made from the tooling up stage to the finished product. The results are intended to provide programmers with a practical criteria for choosing a programming language to meet their needs. The criteria provides a concrete and quantitative evaluation of the fundamental characteristics of the programming systems showing the total cost of programming in function of the job description. Results indicate that the use of a large computer in telecommunication with the machine is economically interesting for low output jobs (< or = 20 parts/month) while for larger jobs the use of a minicomputer by the programmer on the site is preferable.
Author (ESA)

N79-29870# Centre de Recherches Scientifiques et Techniques de l'Industrie des Fabrications Metalliques, Brussels (Belgium). Sect. Informatique Industrielle.
DECENTRALIZED AUTOMATIC CONTROL SYSTEMS ARCHITECTURE USING MICROPROCESSORS [STRUCTURES DE COMMANDE AUTOMATIQUE DECENTRALISEE UTILISANT DES MICROPROCESSEURS]
Pierre Gaspart May 1977 38 p In FRENCH Sponsored by Inst. de Rech. Sci. pour l'Ind. et l'Agr.
(CRIF-IN-5) Avail: NTIS HC A03/MF A01

A control system is described whose architecture is intrinsically reliable as it is largely decentralized. The system is discussed in terms of automatic control of industrial processes. The system is of the 'passive reliability' type such that if any one module fails only the control functions directly handled by this module are effected while the other modules continue to operate with a very slight reduction in efficiency. A further evolution of the system is discussed in terms of additional modules whose function is to monitor the primary control system, taking over the functions of any faulty component in the event of detecting a failure. Conclusions indicate the need for developing a generalized coupler based on the use of bipolar programmable micropressors. This coupler must satisfy ergonomic specifications resulting from its use by personnel which are not necessarily familiar with computer languages. Author (ESA)

N79-29871# Ecole Nationale Superieure des Telecommunications, Paris (France).
RESEARCH ON OPTIMAL CONTROL ADAPTED TO MACRO AND MICROECONOMICS: A SURVEY
Louis-Francois Pau 1978 27 p refs Presented at 7th Triann. World Cong., Helsinki, Jun. 1978
(ENST-C-78021) Avail: NTIS HC A03/MF A01

Macro and microeconomic policy applications of control theory are surveyed stressing a decentralized framework. Reference is given to applications of the various control techniques. The economic models are specified in terms of the sectoral decomposition, the information structure, the decision structure, and the team structure. Additional phenomena frequently encountered in economics are discussed. These include errors and uncertainties, multiple control periodicities, econometric estimation, learning and dual control, information lead or lag, instrumental stability, forbidden policies and intermediate target policies, welfare functionals, and one-level and two-level planning with conflicting goals. Areas for applications and research are listed.
Author (ESA)

N79-29872# Ecole Nationale Superieure des Telecommunications, Paris (France). Dept. Electronique et Physique.
MULTIPLE CRITERIA DETERMINISTIC DECENTRALIZED CONTROL: RECURSIVE EQUILIBRIUM ADAPTATION AND EXAMPLES
Louis-Francois Pau 1979 34 p refs Submitted for publication
(ENST-C-79003) Avail: NTIS HC A03/MF A01

A system decomposed with respect to (N + 1) conflicting controls organized into two priority levels, the higher of which carries out the coordination task of most decentralized strategies is considered. The deterministic framework in terms of decision and information structures as well as interlevel constraint coordination is presented; recursive equilibrium adaptation algorithms, called iterative negotiation procedures, are developed within decentralized closed loop strategies in the presence of conflicting criteria. Three analytical examples demonstrating the effects of the conflicting criteria and of the information structure on the functional nature of the decentralized strategies are shown. Author (ESA)

64 NUMERICAL ANALYSIS

Includes iteration, difference equations, and numerical approximation.

N79-29873 Kentucky Univ., Lexington.
ABSOLUTELY PURE MODULES Ph.D. Thesis
David Duane Adams 1978 56 p
Avail: Univ. Microfilms Order No. 7918066

Basic notions involving absolutely pure modules are explained, and their similarity to injective modules is noted. The main result is stated in proposition 2 which asserts that every module can be embedded in an absolutely pure module (not necessarily injective) in a 'nice way'. Module theoretic characterizations of various classes of rings are given. It is shown that a ring R is left coherent if and only if inductive limits of absolutely pure left R-modules are absolutely pure. Some properties of absolutely pure modules under change of rings are studied and applied. A categorical formulation of a definition of covers and envelopes and a brief discussion of what is called absolutely pure covers and envelopes is presented. It is shown that, over certain rings, every module has an absolutely pure cover (respectively, envelope). Dissert. Abstr.

N79-29874 Indiana Univ., Indianapolis.
EXISTENTIAL COMPLETIONS OF MODULES Ph.D. Thesis
Anthony Karl Dean 1979 145 p
Avail: Univ. Microfilms Order No. 7916936

If T is a universal theory with model completion T^* and A is a model of T, a prime model of T^* the sum of diagram (A) is called an existential completion of A. The model completion of a model is analogous to the algebraic closure of a field, and is so named since the models of T^* are the existentially complete models of T. The conditions which ensure that every or certain lambda-modules have existential completions are investigated. It is shown that: (1) for Noetherian rings lambda, every lambda-module has an existential completion unique up to isomorphism

over that lambda-module; (2) for strongly regular rings lambda, the hypotheses of the theorem are satisfied if and only if the isolated points are dense in the structure space of lambda; (3) for suitable coherent rings, an absolutely pure lambda-module is existentially complete if and only if its dimensions are sufficiently large; and (4) if lambda is a Peano ring, every lambda-module has an existential completion if lambda has a countable subset with upper bound. Dissert. Abstr.

N79-29876 Utah Univ., Salt Lake City.
ON THE SPECTRA OF HOLOMORPHIC FUNCTION ALGEBRAS Ph.D. Thesis
William David Emerson 1979 62 p
Avail: Univ. Microfilms Order No. 7918497

Let (M,p) be a Riemann domain. It is said that (M,p) is a stacked domain if M = IN x omega, where Omega is a Stein domain in slashed C to the Nth power and IN is the set of natural numbers. If A is a closed subalgebra of O(M) such that O(Omega)op is contained in A, then it is said that A is nontrivial. R denotes the equivalance relation defined on M by A. If A is a nontrivial algebra on a stacked domain M, then the spectrum Delta(A) with the compactly generated Galfand topology kG is homeomorphic to the quotient space M/R with the quotient topology Q. Let (M,p) be a Riemann domain and let A be a closed subalgebra of O(M) containing the coordinate functions. It is said that an algebra is stable if it is closed under differentiation. Dissert. Abstr.

N79-29876 Pittsburgh Univ., Pa.
MEMORY MANAGEMENT FOR SOLUTION OF LINEAR SYSTEMS ARISING IN FINITE ELEMENT SUBSTRUCTURING Ph.D. Thesis
Franics Carroll Wimberly, III 1978 95 p
Avail: Univ. Microfilms Order No. 7917506

The linear systems that arise in finite element analysis of realistic problems are too large to store in the memory of even large computers. When periopheral storage devices such as disks are used, processing time increase dramatically. Focusing on substructuring problems, data representations and buffering schemes were combined with: (1) point direct; (2) point iterative; (3) block direct; and (4) block iterative numerical solution techniques to form overall solution strategies. These strategies were applied to realistic stress analysis problems in an experimental approach with the goal of relating properties of problems to the most suitable method for solving them. A methodology for discovering near optimal buffering schemes were tested. Dissert. Abstr.

N79-29877 Princeton Univ., N. J.
NEW OBSERVATION-OUTLIER-RESISTANT METHODS OF SPECTRUM ESTIMATION Ph.D. Thesis
Michael Schwarzschild 1979 158 p
Avail: Univ. Microfilms Order No. 7918569

The problem of estimating the spectrum of a stationary time series when the series can only be sampled after it was contaminated by outliers is addressed. These outliers are generated by values of a new, second series being added on to some subset of the original series. First, one of several outlier detection procedures is proposed that examines the scaled second differences of the outlier-contaminated data in order to reasonably designate, or flag, some set of points as outliers. The flagged points are replaced by linear or nonlinear interpolation through nearby points. A spectrum estimate is then computed from the processed data. A transfer function of a linear filter is used to correct the spectrum estimate for some of the bias caused by the processing. Some theory about the asymptotic properties of M-estimates computed from stationary processes is discussed. Dissert. Abstr.

N79-29878 Michigan Univ., Ann Arbor.
THE FINITE-ELEMENT METHOD AND THE STEFAN PROBLEM Ph.D. Thesis
Antonio Valle 1979 331 p
Avail: Univ. Microfilms Order No. 7916836

A finite-element approach is presented for solving the nonlinear partial differential equations describing heat transfer and fluid flow in the normal freezing of naphthalene, which freezes at 80 C. The problem which is considered as a transient two-dimensional axially symmetrical freezing problem involving natural convection in a newtonian incompressible liquid melt, is formulated in terms of two simultaneous partial differential equations: a fourth-order nonlinear equation in stream function, and a second-order nonlinear equation in temperature. The latent heat effects emerging as a result of a change of phase are accounted for by a heat generation term in the energy equation. Based on the results the finite difference method is more efficient for the solution of Stefan problems than the finite element method used. Dissert. Abstr.

N79-29879 Minnesota Univ., Minneapolis.
THE INTERRELATIONSHIP BETWEEN THE THEORY OF CHARACTERISTIC EXPONENTS AND THE SPECTRAL THEORY Ph.D. Thesis
Robert Randolph Hastings 1979 128 p
Avail: Univ. Microfilms Order No. 7918340

The asymptotic behavior of the solutions of the linear differential system (*) x prime = A(t)x, where x is in R(n) or C(n), is studied. The results of the spectral theory for linear skew product flows (LSPF) are presented. The definition of the auxiliary indexes for the system (*) are extended to an arbitrary LSPF on a vector bundle. It is shown that the auxiliary indexes are in the spectrum. Additional results are given in the case where the base space Y of the vector bundle is a uniquely ergodic minimal set. It is shown that for the system (*) there exists a Lyapunov transformation y = L*(-1)(t)x such that the transformed system y prime = B(t)y has a block diagonal structure corresponding to the spectral decomposition of the LSPF induced by system (*). A proof of Coppel's theorem which shows that point spectrum is equivelent to 'almost reducible' is given. Two examples which show that almost periodic systems do not necessarily have point spectrum are presented. A generalization of a theorem dealing with the density of the set of almost periodic systems with point spectrum is given. Dissert. Abstr.

N79-29880 Stanford Univ., Calif.
COVARIANCE FACTORIZATION TECHNIQUES FOR LEAST SQUARES ESTIMATION Ph.D. Thesis
James Roy Dobbins 1979 217 p
Avail: Univ. Microfilms Order No. 7917223

Square root, least squares estimation algorithms are examined from the viewpoint that square root arrays are arrays expressing relevant problem random variables in terms of basic sets of orthonormal (identity covariance) random variables. With this viewpoint, projection-theorem arguments are expressed directly in the square root arrays, giving simple, geometric derivations of square root algorithms. A unifying framework is provided for previously proposed square root algorithms (and square-root-free factorization algorithms), and several new square root estimation procedures are derived. Dissert. Abstr.

N79-29881 University of South Florida, St. Petersburg.
NONPARAMETRIC DENSITY ESTIMATION WITH APPLICATIONS Ph.D. Thesis
Steven Jon Bean 1979 167 p
Avail: Univ. Microfilms Order No. 7917099

Due to the large volume of literature in the area, the basic concepts in the major works are covered without going into very extensive detail. Variable bandwidth kernel estimators are proposed. Several different forms of variable bandwidth kernel estimators were studied. The large sample asymptotic properties of the proposed new estimators were examined. The question of bandwidth selection is considered for both fixed and variable bandwidth kernel estimators. Regression models based on several different types of kernel estimators of multivariate density functions are developed. The asymptotic properties of the regression or prediction models was investigated. A problem in astrometry was studied. Dissert. Abstr.

N79-29882 Princeton Univ., N. J.
THE MODEL THEORY OF PYTHAGOREAN FIELDS Ph.D. Thesis
William Burkley Jacob 1979 102 p
Avail: Univ. Microfilms Order No. 7918768

Several explicit constructions of evaluations on formally real fields were studied. An explicit Nullstellensatz for IR of t is derived. Complete axioms for certain Hereditarily - Pythagorean

fields are given, and these are model complete in an appropriate language. Evaluations are given for a field theoretic interpretation of M Marshall's structure theory for spaces of orders, and with this we are able to prove Milnor's conjectures in k-theory in the case of Pythagorean fields with finite chain length. It was shown that for any finitely generated reduced Witt ring R, the class of fields K, for which there is a surjective ring homomorphism from W(K) to R, has a decidable model companion.

Dissert. Abstr.

N79-29883# Pittsburgh Univ., Pa. Dept. of Electrical Engineering.

APPROXIMATION METHODS IN MULTIDIMENSIONAL FILTER DESIGN Interim Report, 1 Jan. 1978 - 31 Jan. 1979

N. K. Bose 28 Feb. 1979 21 p refs

(Grant AF-AFOSR-3542-78; AF Proj. 2304)

(AD-A067917; AFOSR-79-0421TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

First, new stability tests were developed for multidimensional recursive digital filters and any double-ended n-dimensional noncausal linear processor which is said to be stable if its impulse response decreases exponentially in all 2-n directions. It was then shown that the impulse response operator for a 2-D discrete Hilbert transformer, though not by itself sum-separable, becomes so after appropriate classification. Subsequently it was proved that the multiplicative complexity of computation of a 2-D DHT is not greater than twice the sum of multiplicative complexities of two 1-D DHT's. Subsequently, the 1-D matrix Pade approximation problem via a three-term recursive computation scheme was tackled as a prelude to the solution of 2-D and n-D cases. Specifically, given a 1-D matrix power series, it was shown that a recurrence relation relates the ((L-1)/(M-1)), (L/M), ((L-1)/(M-1)) order Pade approximants, which are guaranteed to exist provided a certain rank condition is satisfied by characterizing matrices possessing block-Hankel structure. Attention to stability, algebraic computational complexity and approximation were necessary because efficient implementation of stable recursion is desired.

Author (GRA)

N79-29884# Stanford Univ., Calif. Dept. of Computer Science.

A UNIFIED APPROACH TO PATH PROBLEMS

Robert Endre Tarjan Apr. 1979 44 p refs

(Contract N00014-76-C-0688; Grant NSF MCS-75-22870)

(AD-A068229; STAN-CS-79-729) Avail: NTIS HC A03/MF A01 CSCL 12/1

We describe a general method for solving path problems on directed graphs. Such path problems include finding shortest paths, solving sparse systems of linear equations, and carrying out global flow analysis of computer programs. Our method consists of two steps. First, we construct a collection of regular expressions representing sets of paths in the graph. This can be done by using any standard algorithm, such as Gaussian or Gauss-Jordon elimination. Next, we apply a natural mapping from regular expressions into the given problem domain. We exhibit the mappings required to find shortest paths, solve sparse systems of linear equations, and carry out global flow analysis. Our results provide a general-purpose algorithm for solving any path problem, and show that the problem of constructing path expressions is in some sense the most general path problem. GRA

N79-29885# Stanford Univ., Calif. Dept. of Computer Science.

NUMERICAL COMPUTATION OF THE SCHWARZ-CHRISTOFFEL TRANSFORMATION

Lloyd N. Trefethen Mar. 1979 54 p refs

(Contract N00014-75-C-1132)

(AD-A068210; Su-STAN-CS-79-710) Avail: NTIS HC A04/MF A01 CSCL 12/1

A program is described which computes Schwartz-Christoffel transformations that map the unit disk conformally onto the interior of a bounded or unbounded polygon in the complex plane. The inverse map is also computed. The computational problem is approached by setting up a nonlinear system of equations whose unknowns are essentially the accessory parameters z sub k. This system is then solved with a packaged subroutine. New features of this work include the evaluation of integrals within the disk rather than along the boundary, making possible the treatment of unbounded polygons; the use of a compound form of Gauss-Jacobi quadrature to evaluate the Schwarz-Christoffel integral, making possible high accuracy at reasonable cost; and the elimination of constraints in the nonlinear system by a simple change of variables. Schwarz-Christoffel transformations may be applied to solve the Laplace and Poisson equations and related problems in two-dimensional domains with irregular or unbounded (but not curved or multiply connected) geometries. Computational examples are presented. The time required to solve the mapping problem is roughly proportional to N-cubed, where N is the number of vertices of the polygon. A typical set of computations to 8-place accuracy with N = or < 10 takes 1 to 10 seconds on an IBM 370/168. GRA

N79-29886# Stanford Univ., Calif. Dept. of Computer Science.

A POLYNOMIAL TIME ALGORITHM FOR SOLVING SYSTEMS OF LINEAR INEQUALITIES WITH TWO VARIABLES PER INEQUALITY

Bengt Aspvall and Yossi Shiloach Jan. 1979 28 p refs

(Contract N00014-78-C-0330; Grants NSF MCS-77-23738; NSF MCS-75-22870)

(AD-A068228; Su-STAN-CS-79-703) Avail: NTIS HC A03/MF A01 CSCL 12/1

We present a constructive algorithm for solving systems of linear inequalities (LI) with at most two variables per inequality. The algorithm is polynomial in the size of the input. The LI problem is of importance in complexity theory since it is polynomial time equivalent to linear programming. The subclass of LI treated in this paper is also of practical interest in mechanical verification systems, and we believe that the ideas presented can be extended to the general LI problem. Author (GRA)

N79-29887# Wisconsin Univ. - Madison. Mathematics Research Center.

TRIPLEX ARITHMETIC FOR FORTRAN

Klaus Boehmer and J. M. Yohe Dec. 1978 43 p refs

(Contract DAAG29-75-C-0024)

(AD-A068847; MRC-TSR-1901) Avail: NTIS HC A03/MF A01 CSCL 09/2

Triplex arithmetic is a variant of interval arithmetic in which a 'main' value is computed in addition to the endpoints of the containing interval. The 'main' value is, in general, the value that would have been computed had properly-rounded real arithmetic been used to compute the results of the calculation; it may in some sense, be regarded as the 'most probable' value of the result of the calculation. The endpoints of the interval define the worst-case range of the possible values of the computation. This report describes a FORTRAN implementation of triplex arithmetic in both single and multiple precision. The package described in this report is designed to be used with the AUGMENT precompiler: this makes triplex arithmetic particularly easy to use. Author (GRA)

N79-29888# Wisconsin Univ. - Madison. Mathematics Research Center.

RANGES OF PRIOR MEASURES

Lorraine DeRobertis and J. A. Hartigan Jan. 1979 25 p refs

(Contract DAAG29-75-C-0024; Grants NSF MCS-78-09525; NSF MCS-75-08374)

(AD-A068937; MRC-TSR-1915) Avail: NTIS HC A02/MF A01 CSCL 12/1

Partial prior knowledge is quantified by a range R(L,U) of sigma-finite prior measures Q satisfying L(A) < or = Q(A) < or = U(A) for all measurable sets A, and is interpreted as a probability statement in a betting framework. The concept of conditional probability distributions is generalized to that of conditional measures, and Bayes theorem is extended to accommodate unbounded priors. According to Bayes theorem, the range R(L,U) of prior measures is transformed upon observing X into a similar range R(LX,UX) of posterior measures. Upper and lower expectations and variances induced by such ranges of measures are obtained. Under weak regularity conditions, these upper and lower posterior expectations are strongly consistent estimators. The range of posterior expectations of an arbitrary function b on the parameter space is asymptotically b sub N + or - alpha sigma sub N + o(sigma sub N) where b

sub N and sigma-squared sub N are the posterior mean and variance of b induced by the upper prior measure U, and where alpha is a constant reflecting the uncertainty about the prior in terms of the derivative of L with respect to U. Author (GRA)

N79-29889# Wisconsin Univ. - Madison. Mathematics Research Center.

ERROR ANALYSIS OF A LINEAR SPLINE METHOD FOR SOLVING AN ABEL INTEGRAL EQUATION

Hing-Sum Hung Dec. 1978 20 p refs
(Contract DAAG29-75-C-0024)
(AD-A068896; MRC-TSR-1904) Avail: NTIS
HC A02/MF A01 CSCL 12/1

A linear spline method for the solution of the Abel integral equation is analyzed. The approximate solution along with its derivative converges to the corresponding exact solutions at each point in the interval of integration, the orders of convergence being two and one, respectively. An asymptotic formula for the discretization error is obtained. The method is illustrated by a numerical example. GRA

N79-29890# Wisconsin Univ. - Madison. Mathematics Research Center.

INVARIANT SETS FOR NONLINEAR ELLIPTIC AND PARABOLIC SYSTEMS

Hendrik J. Kuiper Jan. 1979 47 p refs
(Contract DAAG29-75-C-0024)
(AD-A068931; MRC-TSR-1909) Avail: NTIS
HC A03/MF A01 CSCL 12/1

Systems of coupled second order parabolic equations, or reaction-diffusion equations, arise in the mathematical models of various physical, chemical and biological processes. They describe the evolution in time of two or more substances which interact and diffuse. More specifically, reaction-diffusion equations arise in chemical reactor theory (where the components are concentrations of chemicals), in ecology (densities of species), in the theory of combustion (densities of fuel and thermal energy), and in the theory of nerve impulse transmission (densities of chemicals and electric charges). At any instant of the densities, which are functions of the space variables, describe the state of the system. An invariant set S is a collection of states with the property that once the system is in a state which is a member of S then, however else the state will evolve, it will at all later times still be a member of S. Symbolically, if U(t) is the state of the time t then U(t sub 0) an element of S implies U(t) an element of S for all t = t sub 0. In this paper criteria are found which can be used to find invariant sets which are described in terms of upper and lower bounds for the various components of the state. As a by-product existence and comparison results for the associated elliptic problems are obtained. In all results both the equations and the boundary conditions are allowed to be nonlinear. GRA

N79-29891# Wisconsin Univ. - Madison. Mathematics Research Center.

ON CARDINAL SPLINE SMOOTHING

I. J. Schoenberg Jan. 1979 17 p refs
(Contract DAAG29-75-C-0024)
(AD-A068936; MRC-TSR-1914) Avail: NTIS
HC A02/MF A01 CSCL 12/1

The paper has two parts. In part I it describes the old results on the problem of smoothing a given bi-infinite sequence of equidistant data. It includes the main results on the cardinal spline interpolation of equidistant data of power growth. All this is meant as background for the new developments in Part II. In Part II a method of smoothing a sequence of equidistant data is presented. It is based on the ideas of E. T. Whittaker. GRA

N79-29892# Wisconsin Univ. - Madison. Mathematics Research Center.

AN APPROXIMATION OF INTEGRABLE FUNCTIONS BY STEP FUNCTIONS WITH AN APPLICATION

M. G. Crandall and A. Pazy Jan. 1979 13 p refs
(Contract DAAG29-75-C-0024; Grant NSF MCS-78-01245)
(AD-A068933; MRC-TSR-1911) Avail: NTIS
HC A02/MF A01 CSCL 12/1

A method of approximating functions which are integrable on 0, infinity by piecewise constant functions is presented and studied in this paper. The method used and the properties established for it allow one to reduce the study of the convergence of a difference method of theoretical interest for nonlinear time-dependent problems with forcing terms to the simpler study of related problems without forcing terms. GRA

N79-29893# Wisconsin Univ. - Madison. Mathematical Research Center.

POWER SERIES METHODS 1: ORDINARY DIFFERENTIAL EQUATIONS

Robert D. Small Feb. 1979 23 p refs 3 Vol.
(Contract DAAG29-75-C-0024)
(AD-A068939; MRC-TSR-1923) Avail: NTIS
HC A02/MF A01 CSCL 12/1

A method is presented for constructing finite difference schemes of high accuracy for ordinary differential equations. Since it is based on power series representation of the solution it is applicable to partial differential equations as well. The method is demonstrated on the general nonlinear first order ordinary differential equation and the truncation errors are analyzed. A-stability of the method is analysed and it is found to be stable in this sense to arbitrarily high order. Finally, a nonlinear example is presented. GRA

N79-29894# Wisconsin Univ. - Madison. Mathematics Research Center.

POWER SERIES METHODS 2: THE HEAT EQUATION

Robert D. Small Feb. 1979 32 p refs 3 Vol.
(Contract DAAG29-75-C-0024)
(AD-A068940; MRC-TSR-1924) Avail: NTIS
HC A03/MF A01 CSCL 12/1

The power series method is applied to the heat equation. Highly accurate semi-discrete systems of equations in t and in x are generated and are made stable by proper choice of parameters. A totally discrete scheme is produced that represents arbitrarily high accuracy in both x and t. Stability analysis indicates that while arbitrary order in t may be stable, the order of accuracy in x is restricted to be less than 16 and certain geometrical restrictions on the step sizes must be met. Truncation errors are examined and a consistency condition is obtained that further restricts the step sizes. The scheme is shown to coincide with Keller's Box scheme in its lowest order. GRA

N79-29895# Wisconsin Univ. - Madison. Mathematics Research Center.

POWER SERIES METHODS 3: THE WAVE EQUATION

Robert D. Small Feb. 1979 29 p refs 3 Vol.
(Contract DAAG29-75-C-0024)
(AD-A068941; MRC-TSR-1925) Avail: NTIS
HC A03/MF A01 CSCL 12/1

The power series method used to generate highly accurate finite difference schemes for ordinary differential equations is here applied to the wave equation. The analysis involves semi-discrete approximations in t and in x before the totally discrete scheme is derived. The results differ in that an arbitrarily accurate difference scheme is found for the wave equation that is stable and consistent with the differential equation. No such scheme exists for the heat equation. The step sizes in x and t must be equal for this difference scheme. Other difference schemes that do not restrict the step sizes are stable only when the order of accuracy in x is less than 5. The lowest order scheme is shown to coincide with Keller's Box Scheme. GRA

N79-29896# Carnegie-Mellon Univ., Pittsburgh, Pa. Management Sciences Research Group.

THE LINEAR MULTIPLE CHOICE KNAPSACK PROBLEM

Eitan Zemel Apr. 1979 17 p refs Revised
(Contract N00014-76-C-0621; Grant NSF MCS-76-12026)
(AD-A069129; MSRR-434) Avail: NTIS HC A02/MF A01 CSCL 12/1

We discuss a fast algorithm for the linear programming relaxation of the Multiple Choice Knapsack Problem. Let N be the total number of variables in this problem and let J and J sub max denote the total number of multiple choice variables and the cardinality of the largest multiple choice set, respectively. The running time of the algorithm is then bounded by O(J log J sub max) + O(N). Under certain conditions it is possible to

reduce this bound to O(N) steps on the average. Possible further improvements are also discussed. GRA

N79-29897# Ballistic Research Labs., Aberdeen Proving Ground, Md.
ADAPTIVE ACCELERATION OF SSOR FOR SOLVING LARGE LINEAR SYSTEMS Final Report
Vitalius Benokraitis Mar. 1979 19 p refs
(DA Proj. 1L1-61102-AH-43)
(AD-A069133; AD-E430231; ARBRL-TR-02147) Avail: NTIS HC A02/MF A01 CSCL 12/1

Symmetric successive overrelaxation (SSOR) for solving large, sparse systems of linear equations involves the estimation of a parameter omega. An adaptive procedure is outlined for improving the estimates for omega and the spectral radius S(Sigma omega) of the iteration matrix Sigma omega. These estimates are then used in the SSOR method with Chebyshev acceleration. The objective is to achieve convergence in only a few more iterations than would be required if the best possible values of omega and S(Sigma omega) were used from the outset. The method is applied to obtain finite difference solutions of a number of generalized Dirichlet problems. In certain cases, the number of iterations required using the adaptive procedure increases like h to the minus 1/2 power, where h is the mesh size. GRA

N79-29898# Wisconsin Univ. - Madison. Mathematics Research Center.
ERROR ESTIMATES FOR THE APPROXIMATION OF AN UNKNOWN CONSTANT COEFFICIENT IN A PARTIAL DIFFERENTIAL EQUATION
Richard S. Falk Dec. 1978 39 p refs
(Contract DAAG29-75-C-0024; Grant NSF MCS-78-02737)
(AD-A068848; MRC-TSR-1902) Avail: NTIS HC A03/MF A01 CSCL 12/1

A priori error estimates are derived for the approximation of an inverse problem in which it is desired to identify an unknown constant coefficient in a one space dimensional parabolic or two space dimensional elliptic partial differential equation whose general form is known. GRA

N79-29899# Wisconsin Univ. - Madison. Dept. of Statistics.
HOW TO SMOOTH CURVES AND SURFACES WITH SPLINES AND CROSS-VALIDATION
Grace Wahba Mar. 1979 15 p refs
(Contract N00014-77-C-0675; Grant DAAG29-77-G-0207)
(AD-A068430; UWIS-DS-555) Avail: NTIS HC A02/MF A01 CSCL 12/1

The use of smoothing splines and the method of generalized cross validation (GCV) for smoothing discrete noisy data from an unknown but smooth curve is reviewed. The use of 'plaque mince' or Laplacian smoothing splines with GCV for smoothing discrete noisy data from an unknown but smooth surface is described. A numerical algorithm for this (non-trivial) computational problem is described, and an example from a Monte Carlo study is presented to show how the method works on simulated data. The results are extremely promising. Some design problems are briefly mentioned. Some conjectures are made concerning optimality properties of Laplacian smoothing splines and Laplacian histosplines. GRA

N79-29900# Lincoln Lab., Mass. Inst. of Tech., Lexington.
A SHORT CATALOG FOR INTERPRETING OPERATING CHARACTERISTIC CURVES AND AN APPLICATION TO MULTIPLE TESTING
Nathan E. Lindgren 31 Jan. 1979 20 p
(Contract F19628-78-C-0002; DA Proj. 8X3-63304-D-215)
(AD-A068359; TN-1979-2; ESD-TR-79-21) Avail: NTIS HC A02/MF A01 CSCL 12/1

In a classification rule for deciding between two possible classes, generally a single threshold test is used. If, however, one or both of the class probability density functions for the decision variable is multimodal or if the class variances are unequal, the situation may arise where it becomes desirable to use multiple thresholds to bracket several regions of the decision variable assigned to the two classes. An easy count of the number of inflection points in the operating characteristic curve generated from the single threshold case permits determination of the maximum number of thresholds that should be used.
Author (GRA)

N79-29901# Florida State Univ., Tallahassee. Dept. of Statistics.
FUNCTIONS DECREASING IN TRANSPOSITION WITH APPLICATIONS TO SHOCK, DAMAGE, AND DOWN TIME
Myles Hollander, Frank Proschan, and Jayaram Sethuraman Mar. 1979 17 p refs
(Grants AF-AFOSR-3678-78; DAAG29-76-G-0238)
(AD-A068239; FSU-STATISTICS-M494; ARO-13888.18-MX; TR-8) Avail: NTIS HC A02/MF A01

In this paper a large class of multivariate densities and frequency functions including the multivariate Poisson distribution and the compound multivariate Poisson distribution, are shown to have the decreasing in transposition property introduced by Hollander, Proschan, and Sethuraman (1977, Ann. Statist. 5, 722-733). Applications relevant to reliability are given, including applications to shock models, cumulation of damage, and component down times. GRA

N79-29902# Naval Research Lab., Washington, D. C.
A FAST APPROXIMATION TO THE COMPLEMENTARY ERROR FUNCTION FOR USE IN FITTING GAMMA-RAY PEAKS Final Report
Gary W. Phillips Apr. 1979 16 p refs
(WF12100000)
(AD-A068368; NRL-MR-3963) Avail: NTIS HC A02/MF A01 CSCL 12/1

A fast approximation to the complementary error function has been programmed and tested for use in the peak-shape function for fitting peaks in gamma-ray spectra. The function was compared for speed and accuracy on the NRL ASC 7 computer to the ASC mathematical library version of the complementary error function. The approximation has resulted in a 50% time savings in the computer program HYPERMET which was developed at NRL for automatic analysis of gamma-ray spectra. Source codes for the test progams are given in an Appendix. GRA

N79-29903# Naval Research Lab., Washington, D. C.
COMPUTER-AIDED DISCOVERY OF A FAST MATRIX-MULTIPLICATION ALGORITHM Final Report
Rodney W. Johnson and Aileen M. McLoughlin 7 May 1979 13 p refs
(RR0140941)
(AD-A069451; NRL-MR-3994) Avail: NTIS HC A02/MF A01 CSCL 12/1

A computer program was written that searches for fast matrix-multiplication algorithms by seeking roots of a certain multivariate polynomial. An algorithm was discovered that, like the one discovered by Laderman, uses 23 noncommutative multiplications in multiplying 3-by-3 matrices. The new algorithm is demonstrably inequivalent to Laderman's in a sense that is made precise. GRA

N79-29904# Stanford Univ., Calif. Dept. of Satistics.
A MARTINGALE INEQUALITY FOR THE SQUARE AND MAXIMAL FUNCTIONS
Louis H. Y. Chen 15 Mar. 1979 14 p refs
(Contract N00014-76-C-0475; Grant DAAG29-77-G-0031)
(AD-A069306; SU-TR-31; SU-TR-270; ARO-14435.31-M) Avail: NTIS HC A02/MF A01 CSCL 12/1

An inequality for weak martingales and nonnegative weak submartingales is proved. Three special cases are deduced, one of which generalizes and refines a result of Austin (1966). As an application of the inequality, the special cases are used to give easy proofs of Burkholder's (1966) L log L and L sub p (for $1 < p <$ or $= 2$) inequalities for the square function of a martingale or a nonnegative submartingale. GRA

N79-29905# Los Alamos Scientific Lab., N. Mex.
MOL1D: A GENERAL PURPOSE SUBROUTINE PACKAGE FOR THE NUMERICAL SOLUTION OF PARTIAL DIFFERENTIAL EQUATIONS
J. M. Hyman Mar. 1979 145 p refs
(Contract W-7405-eng-36)
(LA-7595-MS) Avail: NTIS HC A07/MF A01

MOL1D is a FORTRAN subroutine package for the method of lines solution for systems of initial boundary value partial differential equations in one space dimension. Linear and nonlinear hyperbolic equations with or without discontinuities, linear and nonlinear parabolic equations (including those arising in reaction diffusion equations), and elliptic boundary value problems when posed as the stable time independent solution of a parabolic equation are solved. Systems are handled as easily as single equations, and a wide variety of boundary conditions can be accommodated, including most that arise in applications. The major advantage of the package is that initial value problems are solved accurately with a minimum of programing effort and with moderate computer cost. DOE

N79-29906# California Univ., Berkeley. Lawrence Berkeley Lab.

NUMERICAL INVESTIGATION INTO THE PROPERTIES OF FUZZY NUMBERS

B. A. Cerny Dec. 1978 37 p refs
(Contract W-7405-eng-48)
(LBL-8875) Avail: NTIS HC A03/MF A01

The concepts of fuzzy numbers and fuzzy arithmetic are introduced, and some of their numerical properties were investigated. Fuzzy numbers as extensions of interval numbers, or possibility distributions between upper and lower bounds are presented. These distributions are described as being shape invariant under addition and subtraction and nearly shape invariant under multiplication and division. This shape invariance is assessed through FORTRAN IV programs that multiply and divide fuzzy numbers by two different methods: a point by point manipulation analogous to the convolution of probability densities that gives an exact result, and an approximation to this result obtained by operations on a parameterized form of the possibility distributions. Since this approximation gives tolerable results given the basic intrinsic vagueness of the numbers, sequences of operations on these parameterized fuzzy numbers are examined via a FORTRAN IV program. The resultants are discussed in terms of error propagation. DOE

N79-29907# Sandia Labs., Albuquerque, N. Mex.

NUMERICAL INTEGRATION OF THE EQUATIONS GOVERNING A NORMAL MODE LINEAR PIEZOELECTRIC TRANSDUCER WITH AN INDUCTIVE-RESISTIVE LOAD

S. T. Montgomery Feb. 1979 27 p refs
(Contract EY-76-C-04-0789)
(SAND-78-2143) Avail: NTIS HC A03/MF A01

The use of the WONDY one dimensional Lagrangian wavecode to solve for electromechanically coupled responses of normal mode linear piezoelectric transducers is described. The construction of an appropriate equation of state subroutine for a linear piezoelectric material and an inductive resistive external electrical load is given. DOE

N79-29908# Los Alamos Scientific Lab., N. Mex. Energy Div.

APPROXIMATE INVERSION METHOD FOR FIVE POINT DIFFERENCE MATRIX EQUATIONS

Robert G. Steinke 1979 12 p refs Presented at Computational Methods in Nucl. Eng., Williamsburg, Va., 23-25 Apr. 1979
(Contract W-7405-eng-36)
(LA-UR-79-162; Conf-790402-13) Avail: NTIS HC A02/MF A01

The enhancement of numerical stability and the reduction of calculated effort of fluid dynamics methods development for SIMMER are presented. The evaluation of the pressure change and material density change distributions during a time step was considered. The spatially uncoupled approximate solution to be iterated was replaced with a correct spatially coupled simultaneous solution. This resulted in decreased calculational effort per time step as well as enhanced stability to allow much larger time steps to be taken. This improvement was realized by formulating the correct five diagonal matrix equations in two-dimensional rectilinear geometry and then solving them with an efficient matrix inversion routine. DOE

N79-29909# Sandia Labs., Albuquerque, N. Mex.

EXISTENCE, UNIQUENESS AND VALIDATION OF PARAMETER IMBEDDING EQUATIONS FOR NONLINEAR FREDHOLM INTEGRAL EQUATIONS

M. E. Lord Mar. 1979 22 p refs
(Contract EY-76-C-04-0789)
(SAND-78-1094) Avail: NTIS HC A02/MF A01

A parameter imbedding method for nonlinear Fredholm integral equations produces a Cauchy system involving the solution of the integral equation and an associated resolvent kernel. For such Cauchy systems sufficient conditions are given to guarantee local existence and uniqueness of solutions. A Picard-type theorem utilizing a Lipschitz condition is obtained which yields validation of the Cauchy system. DOE

N79-29910# Ecole Nationale Superieure de Techniques Avancees, Paris (France).

STUDY OF THE STATIONARINESS OF QUADRATIC MIXED FORMS OR THOSE DEFINED AS NEGATIVE WITH DEPENDENT VARIABLES [ETUDE DE LA STATIONNAIRE DE FORMES QUADRATIQUES MIXTES OU DEFINIES NEGATIVES DE VARIABLES LIEES]

G. Verchery Nov. 1977 9 p refs In FRENCH
(Contract DRET-76/1199)
(Rept-093) Avail: NTIS HC A02/MF A01

The condition of stationariness, found through linear relationships between mixed quadratic forms or those defined as negative, was analyzed in order to show the possibility of transforming this problem into a minima problem for a quadratic form defined positive and associated to the forms and relationships under consideration. The applicability of the method is demonstrated for the case where the relationships pertain uniquely to the variables corresponding to the part of the form defined negative. The result is obtained by inverting the matrix representing that part of the quadratic form defined as negative. Author (ESA)

N79-29911# Research Inst. of National Defence, Stockholm (Sweden).

SOME MATHEMATICAL FORMALISMS FOR COORDINATE TRANSFORMATIONS [NAAGRA MATEMATISKA FORMALISMER VID KOORDINATTRANSFORMATIONER. BESKRIVNINGAR SAMT JAAMFOERELSER]

Karl-Erik Olsson Nov. 1978 81 p refs In SWAHILI
(FOA-C-20274-E3) Avail: NTIS HC A05/MF A01

The various parametrical representations of the orientation of a free moving body are described. The formalisms used to determine the transformation matrix between a fixed body coordinate system and some other reference system are discussed. A relationship between the parameters in the different representations is established. Some comparisons are made between the formalisms. Different points of view on the choice of the more adequate formalism for simulation and for real time operation are given. Some FORTRAN routines which can be used for computerized simulation program development are presented. Author (ESA)

N79-29912# Stuttgart Univ. (West Germany). Inst. fuer Statik und Dynamik der Luft- und Raumfahrtkonstruktionen

IMPROVED SOLUTION METHODS FOR INELASTIC RATE PROBLEMS

J. H. Argyris, L. E. Vaz, and K. J. William Aug. 1978 83 p refs
(ISD-249) Avail: NTIS HC A05/MF A01

An assessment of incremental solution methods for the analysis of inelastic rate problems is presented. In particular, the possibilities of the initial load method are explored to improve the accuracy and stability of the traditional explicit operators by higher order time expansions and implicit weighting schemes. The family of linear single step methods is extended to cubic Hermitian time expansions which furnish far better accuracy than linear expansions for very little increase of computational cost. Stability and convergence limits correspond to those of the lower order operators, whereby the implicit midstep or backward weighting schemes are most advantageous. In this context it is worth noting that aging or strain hardening effects in the inelastic growth law dramatically reduce the time step restrictions of iterative initial load solution methods (predictor-corrector schemes) as compared to the simples creep model in which the inelastic growth law depends only on stress, e.g. in viscous flow and viscoplastic laws. Author (ESA)

65 STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

N79-29913 California Univ., Berkeley.
SOME CONTRIBUTIONS TO BAYESIAN NONPARAMETRIC STATISTICAL INFERENCE Ph.D. Thesis
Albert Yee-Lap Lo 1978 74 p
Avail: Univ. Microfilms Order No. 7914676

The following two problems are investigated: (1) Bayesian nonparametric statistical influence for Poisson point processes; and (2) weak convergence for posterior Dirichlet processes. In the first problem, a random measure is said to be selected by an integral gamma prior probability if the values it assigns to disjoint sets are independent random variables with positive multipliers. In the second problem, sufficient conditions for the weak convergence of a sequence of continuous time Markov processes with each sample realization in D[0, 1] are provided. Dissert. Abstr.

N79-29914 Rutgers - The State Univ., New Brunswick, N. J.
TWO-SAMPLE NON-PARAMETRIC SEQUENTIAL LIFE TESTING USING THE PROGRESSIVELY CENSORED SAVAGE STATISTIC Ph.D. Thesis
Martin Lawrence Lesser 1979 147 p
Avail: Univ. Microfilms Order No. 7916152

Two hypotheses testing problems: H sub 0:F = G vs. H sub 2:F greater than G and H sub 1:F less than G vs. H sub 2:F greater than G, are addressed. In either case, m and n objects from the F and G treatments, respectively, are placed on life test and the ordered failure times in the combined sample are observed. The use of a progressively censored version of the Savage statistic is investigated. For testing H sub 0 against H sub 2, a nonsequential censored Savage test was defined and compared to a proposed sequential test based on the progressively censored Savage statistic. Two measurement measures of asymptotic efficiency are defined and it is shown that the sequential test performs better than the nonsequential test in most cases of interest. The ethical implications of designing such life tests are discussed. Dissert. Abstr.

N79-29915 Columbia Univ., New York.
FIXED SIZE CONFIDENCE REGIONS FOR CERTAIN TIME SERIES PARAMETERS Ph.D. Thesis
John Gebded Kashah 1979 105 p
Avail: Univ. Microfilms Order No. 7916423

To obtain fixed size confidence of regions of size d for a vector of unknown parameters in some time series models, sequential procedures are used. The asymptotic confidence level and asymptotic efficiency of the expected sample size as d tends to 0 are examined in each case. These results involve central limit theory for randomly stopped sequences of random variables and moment problems for stopping times involving dependent random variables. The first case considered is the fixed width interval estimation of the mean of a stationary strong mixing sequence. Next the fixed volume estimation of the regression parameters in the AR(p) model with i.i.d. errors is considered. Lastly, the case of the fixed volume estimation of the autoregression and moving average parameters in the ARMA(q,s) model with i.i.d. Gaussian errors is considered. Dissert. Abstr.

N79-29916 Utah Univ., Salt Lake City.
A MONTE CARLO SIMULATION STUDY OF SELECTED DISTRIBUTED LAG ESTIMATORS Ph.D. Thesis
David Ellsworth Allen 1979 259 p
Avail: Univ. Microfilms Order No. 7915845

Seven estimators were compared on a number of criteria and in a number of experimental settings. The estimators include: Ordinary least squares; ordinary least squares with Cochran-Orcutt iterative filtering for autocorrelation, Almon's estimator; Hannan's efficient estimator; Hannan's constant signal to noise estimator; rational lags estimated nonlinearly (Marquardt's Compromise); and rational lags estimated using Stieglitz and McBrides Procedure. The data were generated (Monte Carlo simulation) in order to achieve control by knowing the true parameters of the processes. Dissert. Abstr.

N79-29917 Oregon State Univ., Corvallis.
A DISTRIBUTION-FREE APPROACH FOR GROUPED SURVIVAL DATA: ANALYSIS AND CALCULATION OF EFFICIENCY Ph.D. Thesis
William Henry Stewart 1979 86 p
Avail: Univ. Microfilms Order No. 7918001

A distribution-free analysis is proposed for inference concerning treatment effects in factorial survival experiments in which the recorded data are grouped by time intervals. A grouped data model is built by applying the continuous-time Cox regression and life model. When the underlying hazard function can be smoothly modeled by some parametric form, the efficiency of the distribution-free analysis is very high. This efficiency is investigated by considering smoothing restrictions on the previously unrestricted parameters associated with the underlying hazard function of the grouped data model. The distribution-free analysis is geared to give high efficiency for local alternatives to the hypothesis of no treatment effect and for smooth modeling allowing monotone decreasing hazard functions. Dissert. Abstr.

N79-29918 Oregon State Univ., Corvallis.
SMALL SAMPLE PARAMETER ESTIMATION FOR FORCED DISCRETE LINEAR DYNAMIC MODELS Ph.D. Thesis
Donald Lloyd Stevens, Jr. 1979 128 p
Avail: Univ. Microfilms Order No. 7918685

The system model described is conceptualized to include the value of the initial state as a parameter. The forces driving the system are partitioned into accessible and inaccessible inputs. Accessible inputs are those that are measured; inaccessible inputs are all others, including random disturbances. Maximum likelihood and mean upper likelihood estimators are derived. Simulation studies are used to compare the estimators and assess their properties. The mean upper likelihood estimator has consistently smaller mean square error than does the maximum likelihood estimator. An example application is presented, representing a unique realization of a dynamic system. Dissert. Abstr.

N79-29919 Florida State Univ., Tallahassee.
ESTIMATION OF TIME DEPENDENT PARAMETERS IN THE GAUSS-MARKOV MODEL Ph.D. Thesis
Charles Roger Longbotham 1978 100 p
Avail: Univ. Microfilms Order No. 7917052

A vector-valued stochastic process where mu is a subject of the real line is considered. The relative performance of the linear least square predictor (LLSP) and best linear predictor (BLP) estimators is discussed for three criteria. By all criteria, the BLP is at least as good as the LLSP in estimating X beta (s). A particular BLP of beta (s) is shown to minimize the expected loss for a large class of loss functions. The BLP of X beta (s) is optimal for many loss functions. A special case of the model presented is considered in the control theory literature. The Kalman filtering algorithm gives one BLP for beta (s). For many applications, not enough information is available to find the BLP in this model. In many such cases, an LLSP or another estimator for beta (s) may be found. Most of the results are extended to the nonlinear estimation problem. Dissert. Abstr.

N79-29920 Oregon State Univ., Corvallis.
CLASSIFICATION ERRORS IN THE ANALYSIS OF FOURFOLD TABLES Ph.D. Thesis
Md. Abusaleh Abdullah 1979 126 p
Avail: Univ. Microfilms Order No. 7917993

The magnitude of effects of misclassification and the importance of misclassification error rates on estimates of proportions and variances of these estimates were examined. Values of the false negative and false positive rates associated with medical screening were reviewed to determine typical levels of error rates occurring in practice. An attempt was made to determine how robust the usual statistical procedure for analyzing a given set of data is against these classification errors. Substantial effects of misclassification on the estimation of parameters as well as on hypothesis testing showed the importance of estimating the values of the misclassification rates. The randomized response technique was used to estimate error rates and the prevalence rate, for a situation where the true classification can only be obtained directly from the respondent. Dissert. Abstr.

N79-29921 Florida State Univ., Tallahassee.
A MATHEMATICAL STUDY OF SUFFICIENCY AND ADEQUACY IN STATISTICAL THEORY Ph.D. Thesis
Shih-Chuan Cheng 1978 191 p
Avail: Univ. Microfilms Order No. 7917029

A comprehensive and detailed study of the notions of sufficiency and adequacy (prediction sufficiency) in an abstract measure theoretic setting is presented. The notions of Fisher sufficiency and Kolmogorov sufficiency are comparatively studied. A detailed discussion of the notion of conditional independence which plays a central role in the study is included. The Skibinsky definition of adequacy or prediction sufficiency is studied in depth. A Bayesian counterpart, along the lines of Kolmogorov, of the notion of adequacy is proposed. A notion of wide sense adequacy is addressed. A factorization criterion for wide sense adequacy is established and the notion of minimum wide sense adequacy is investigated. The relationship between the notion of Kolmogorov (Bayesian) adequacy and that of wide sense adequacy is investigated. The notion of coherence is briefly discussed. Dissert. Abstr.

N79-29922 Princeton Univ., N. J.
SKEW/STRETCHED DISTRIBUTIONS AND THE t-STATISTIC Ph.D. Thesis
Susan Peterson Arthur 1979 197 p
Avail: Univ. Microfilms Order No. 7918766

Monte Carlo methods are used to find, for a class of skew/stretched tail underlying distributions, the population characteristics which the t confidence interval does cover in a balanced way. That is, the population characteristic for which tail probabilities are equal. Results, presented in a series of tables, indicate that this balanced population characteristic depends on the degree of skewness, the nominal significance level, and the sample size. Charts are presented that summarize tail probability behavior for confidence intervals about the mean and other population characteristics. A class of symmetric/stretched-tail distributions were examined. Dissert. Abstr.

N79-29923# Illinois Univ. at Urbana-Champaign, Urbana. Dept. of Physics.
GAUSSIAN FLUCTUATIONS: 't HOOFT'S METHOD AND AN APPROXIMATION METHOD
Robert A. Neinast and John D. Stack Nov. 1978 45 p refs
(Grant NSF PHY-77-25279)
(ILL-(TH)-78-37) Avail: NTIS HC A03/MF A01

A method for evaluating Gaussian fluctuations around semiclassical field configurations is analyzed. The analysis of the method starts from a soluble quantum mechanical tunneling problem involving a double-wall potential. A one dimensional example with infrared structure similar to that encountered in calculating Gaussian fluctuations around an instanton in non-Abelian gauge theory is given. It is found that the method, which expresses a functional determinant in terms of products of discrete eigenvalues, is valid, provided the correct eigenvalues are used, and certain zero mode normalization factors are handled with care. It is shown that the individual partial wave determinants are infrared divergent. These divergences cancel and yield a finite answer for the full determinant if regulators with spatially varying masses are used. However, it is pointed out that the variable mass regulators always suppress all dependence on the infrared cutoff, so they are in fact acting as regulators in both ultraviolet and infrared regions. An approximate method useful in handling cases where the semiclassical field configuration is more general than a single instanton is proposed. J.M.S.

N79-29924# Texas Univ. at Austin. Center for Cybernetics Studies.
INFORMATION THEORETIC ANALYSIS OF QUESTIONNAIRE DATA
P. Brockett, P. Haaland, and A. Levine Mar. 1979 26 p refs
Presented at the Special Sess. on Statistical and Information Theoretical Modeling, New Orleans, La., 30 Apr. 1979
(Contracts N00014-75-C-0616; N00014-75-C-0569)
(AD-A069019; CCS-336) Avail: NTIS HC A03/MF A01 CSCL 09/4

We consider three important problems in the analysis of categorical questionnaire data. First, assessment of question worth and variable selection, second, the assessment of question validity using a pretest, and third, discrete discriminant analysis when the data is non-ordinal. The unifying approach used throughout is the concept of information theoretic distance measures. Simulations and applications to real data are presented. GRA

N79-29925# Purdue Univ., Lafayette, Ind. Dept. of Statistics.
ON BAYES AND GAMMA-MINIMAX SUBSET SELECTION RULES
Woo-Chul Kim May 1979 111 p refs
(Contract N00014-75-C-0455)
(AD-A069014; Mimeograph-Ser-79-1) Avail: NTIS HC A06/MF A01 CSCL 12/1

Selection and ranking problems arise because the classical tests of homogeneity are often inadequate in practice when the experimenter wishes to make decisions regarding k, where k = or - 2, populations or treatments. Chapter 1 deals with the problem of selecting 'good' populations from a set of k, given populations pi sub 1,...,pi sub k where the quality of each population pi sub i is characterized by an unknown parameter theta sub i. A selection problem arising in reliability theory and another for the selection in terms of scale parameters are considered. The first problem deals with the selection of components (units) for parallel and series systems from k populations (brands) with exponentially distributed life-length times. An optimal rule is derived for the series system and the Bayes rule with respect to a natural conjugate for the 1-out-of-2 system. The second problem deals with the investigation of the selection procedures based on robust estimators of measures of dispersion for selecting the populations in terms of scale parameters. Large sample solutions and the asymptotic relative efficiencies of the proposed procedures are studied. GRA

N79-29926# Wisconsin Univ. - Madison. Mathematics Research Center.
THE NONCENTRAL CHI-SQUARED DISTRIBUTION WITH ZERO DEGREES OF FREEDOM AND TESTING FOR UNIFORMITY Technical Summary Report
Andrew F. Siegel Dec. 1978 19 p refs
(Contract DAAG29-75-C-0024; Grant NSF MCS-75-17385)
(AD-A068849; MRC-TSR-1903) Avail: NTIS HC A02/MF A01 CSCL 12/1

The noncentral chi-squared distribution with zero degrees of freedom is defined as a Poisson mixture of mass at zero together with chi-squared distributions that have even degrees of freedom. Their name is justified by the decomposition of the classical noncentral chi-squared distributions as the sum of a central chi-squared component having the full number of degrees of freedom and an independent noncentral chi-squared component having zero degrees of freedom. The basic properties of this one-parameter family of distributions are given, and they are shown to be useful in the computation of approximate critical values of a test for uniformity. GRA

N79-29927# Naval Surface Weapons Center, Dahlgren, Va.
COMPUTATION OF THE BIVARIATE NORMAL DISTRIBUTION OVER CONVEX POLYGONS Final Report
A. R. DiDonato, M. P. Jarnagin, Jr., and R. K. Hageman Sep. 1978 59 p refs
(AD-A069406; NSWC/DL-TR-3886) Avail: NTIS HC A04/MF A01 CSCL 12/1

A procedure is given for computing the bivariate normal probability over an angular region or a convex polygon. The procedure is implemented into a Fortran IV computer program which is designed to yield 3,6, or 9 decimal digits of accuracy. Comparisons with two other published methods, for the same achievable accuracy, show our program to be much faster. GRA

N79-29928# Stanford Univ., Calif. Dept. of Statistics.
STATISTICAL INFERENCE FOR BOUNDS OF RANDOM VARIABLES
Peter Cooke 3 Apr. 1979 19 p refs
(Contract N00014-76-C-0475; Grant DAAG29-77-G-0031)
(AD-A069180; SU-TR-271; SU-TR-32; ARO-14435.32-M)
Avail: NTIS HC A02/MF A01 CSCL 12/1

Robson and Whitlock (1964) considered point estimation and confidence limits for the upper bound of a random variable when the bound was known to be a truncation point. However,

their approach to the point estimation problem failed to produce an estimator with smaller mean squared error than the largest order statistic from a random sample. In this paper we will construct point estimators of the bounds of random variables which are substantially better estimators than the extreme order statistics for many classes of random variables, including those whose distributions are truncated at one or both ends. We will also construct confidence limits and tests of hypotheses for bounds. The main results are large sample results. GRA

N79-29929# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
A GUIDE FOR THE APPLICATION OF TREND ANALYSIS AND OTHER STATISTICAL METHODS M.S. Thesis
David A. Brunstetter Mar. 1979 158 p refs
(AD-A069743; AFIT/GST/SM/79M-1) Avail: NTIS HC A08/MF A01 CSCL 12/1

This research effort was directed toward offering a practical, effective guidebook for the application of statistical trend analysis methods. Standardization/Evaluation offices throughout the Air Force are required to do trend analysis on measurements taken over time, but those doing it often have no mathematical background. Chapter IV, the user's guide, is written, for them. Ten trend description/trend evaluation methods are offered, nine dealing directly with trend analysis and one with correlation. They are discussed in detail, then are presented in step-by-step guidesheet form. The significance of trends are evaluated using the z-statistic for large samples and the t-statistic for small samples from normal populations. Three more easily applied non-parametric methods are offered for use when time is limited or assumptions for other methods cannot be met. GRA

N79-29930# Fondazione Ugo Bordoni, Rome (Italy).
STATISTICAL STUDY OF SUBJECTIVE MEASUREMENTS [STUDIO STATISTIC SULLE MISURE SOGGETTIVE]
Giovanni Ibba, Andrea Paoloni, Salvatore Miceli, and Antonio Orlando Oct. 1978 12 p refs In ITALIAN Presented at 6th Conv. dell Assoc. Ital. di Acust. 16-18 Oct. 1978, Ivrea, Italy
(FUB-9-1978) Avail: NTIS HC A02/MF A01

Stratified sampling, sample size, and measurement criteria are discussed in order to assess the reliability of subjective measurements. A 95% confidence level repeatability is possible operating with a double stratification sample. Using a family of curves, sample size can be optimized and the attainable confidence level verified. The statistical analysis of results is independent of the chosen measurement methodology (quality judgment or comparison judgment). Author (ESA)

N79-29931# Ecole Nationale Superieure des Telecommunications, Paris (France). Dept. Electronique et Physique.
SIGNAL CLASSIFICATION BY SEQUENTIAL NON-PARAMETRIC TESTS
Louis-Francois Pau 1978 14 p refs In FRENCH Presented at Congr. AFCET/IRIA, 'Reconnaissance des Formes et Traitement des Images', Chatenay-Malabry, France, Feb. 1978
(ENST-C-78020) Avail: NTIS HC A02/MF A01

A signal classification procedure based on a sequential non-parametric hypothesis test is described and the mean sample size needed for a decision is computed. This procedure uses recursive computations and is well suited for simple hardware implementation. Possible applications are in the fields of radar signature classification, gyroscope failure warning, and statistical quality control. Author (ESA)

N79-29932# Ecole Nationale Superieure des Telecommunications, Paris (France). Dept. Electronique et Physique.
FINITE LEARNING SAMPLE SIZE PROBLEMS IN PATTERN RECOGNITION
Louis-Francois Pau 1978 56 p refs Presented at NATO Adv. Study Inst. on Pattern Recognition and Signal Processing, Paris, 26 Jun. - 4 Jul. 1978
(ENST-C-78022) Avail: NTIS HC A04/MF A01

Major problems and solutions relating finite learning sample constraints to the design of a statistical pattern classifier are surveyed. These problems are also put in relation to some application areas where such constraints are critical. It is concluded that the issue of sample based classification leads to very difficult problems and that advances in statistics theory, signal theory, and data analysis are essential to finding acceptable solutions. Author (ESA)

N79-29933# Research Inst. of National Defence, Stockholm (Sweden).
STOCHASTIC MODEL TO CALCULATE THE PROPAGATION OF AEROSOL CLOUDS IN AIR [STOKASTISK MODELL ATT BERAEKNA AEROSOLMOLNS UTBREDNING I LUFT]
Per Aanaes and Christina Holmberg Dec. 1978 46 p In SWAHILI
(FOA-C-40090-B1) Avail: NTIS HC A03/MF A01

A computer model describing aerosol cloud propagation is presented. Propagation of small particles in air is described as a stochastic phenomenon. Parallel calculations were compared using traditional methods and the proposed method. Values were determined for cloud propagation, concentration of particles in air, and fallout on the ground. Results show that under certain meteorological conditions the concentration of particles is very high and that in general results are subject to rather large uncertainties. Some applications for the model are suggested, such as estimating concentrations at various distances from the source. An example of such calculations is shown and the propagation model, calculation formulas, and computer program are described. Author (ESA)

66 SYSTEMS ANALYSIS

Includes mathematical modeling; network analysis; and operations research.

N79-29934 Virginia Univ., Charlottesville.
SYSTEM PARAMETER ESTIMATION USING AN EXTENDED LUENBERGER OBSERVER Ph.D. Thesis
Michael Glendon Price 1978 131 p
Avail: Univ. Microfilms Order No. 7916237

A self-contained theory of state coefficient matrix parameter estimation using an extended Luenberger observer is introduced. State augmentation is used to represent the unknown parameters, which may be constant or time varying. The augmented system is then linearized using a Taylor series and an extended observer/estimator used to provide both state reconstruction and parameter estimation. Conditions for convergence of the estimates are established, and conditions for observability of the augmented system are defined. The study considers both reduced-order and full-order observer/estimators. Dissert. Abstr.

N79-29935 Virginia Polytechnic Inst., Blacksburg.
OPTIMAL ESTIMATION AND CONTROL OF RANDOMLY-SAMPLED SYSTEMS Ph.D. Thesis
Peter Sing-Tong Lee 1978 131 p
Avail: Univ. Microfilms Order No. 7917397

The following general classes of control problems were investigated: systems with adaptive and/or multirate sampling; and decentralized control systems, particularly those with time multiplex communication of data between the physically separated computing elements. A discrete, stationary Markov process is used to model the random sampling phenomenon. An optimal closed loop control law is developed via the method of Dynamic Programming. The existence of the quasi-steady state feedback gains is discussed. Optimal estimation of plant states is presented and the separation of estimation and control is proved to hold. Criteria for the closed loop system to be stable are presented, even with mismatched feedback gains. The control design is applied to the longitudinal dynamics of an F8 aircraft, showing improved performance over corresponding constant gain control laws. The method is related to several extensions such as failure accommodation in large scale systems and multiple model control of nonlinear systems. Dissert. Abstr.

N79-29936 Minnesota Univ., Minneapolis.
CONTRIBUTIONS TO OPTIMAL EXPERIMENTAL DESIGN Ph.D. Thesis
Christopher John Nachtsheim 1979 275 p
Avail: Univ. Microfilms Order No. 7918375

The selection of optimality criteria for regression design in three situations is considered. In the first, the form of the true

model is known and outliers are likely to occur. In the second, the form of the true model is again known, but outliers do not occur. On the basis of these considerations a replacement for the determinant criterion is suggested. In the third situation the true model is an unknown element of a known collection of models. Given a criteria of design optimality, the problem of efficient computer generation of experimental designs is examined in detail. An empirical comparison of existing algorithms for the computer generation of exact optimal experimental designs is also carried out. Dissert. Abstr.

N79-29937# Royal Aircraft Establishment, Farnborough (England).
A MATHEMATICAL MODEL FOR OR STUDIES
H. Schedler Oct. 1978 15 p Transl. into ENGLISH from BMVg-FBWT (West Germany), no. 75-29, 1975 p 35-52 (RAE-Lib-Trans-1995; BR67949) Avail: NTIS HC A02/MF A01

A general mathematical model to be used for the analysis of future Navy weapon systems is presented. The evaluation of weapon system components, operational arrangements, and aspects concerning planning and exercises are included. A.W.H.

N79-29938*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COMPUTERIZED SYSTEMS ANALYSIS AND OPTIMIZATION OF AIRCRAFT ENGINE PERFORMANCE, WEIGHT, AND LIFE CYCLE COSTS
Laurence H. Fishbach 1979 22 p refs Presented at Flight Mech. Panel. Symp. on the Use of Computers as a Design Tool, Munich, 3-6 Sep. 1979; sponsored by AGARD (NASA-TM-79221; E-112) Avail: NTIS HC A02/MF A01 CSCL 12B

The computational techniques utilized to determine the optimum propulsion systems for future aircraft applications and to identify system tradeoffs and technology requirements are described. The characteristics and use of the following computer codes are discussed: (1) NNEP - a very general cycle analysis code that can assemble an arbitrary matrix fans, turbines, ducts, shafts, etc., into a complete gas turbine engine and compute on- and off-design thermodynamic performance; (2) WATE - a preliminary design procedure for calculating engine weight using the component characteristics determined by NNEP; (3) POD DRG - a table look-up program to calculate wave and friction drag of nacelles; (4) LIFCYC - a computer code developed to calculate life cycle costs of engines based on the output from WATE; and (5) INSTAL - a computer code developed to calculate installation effects, inlet performance and inlet weight. Examples are given to illustrate how these computer techniques can be applied to analyze and optimize propulsion system fuel consumption, weight, and cost for representative types of aircraft and missions. J.M.S.

67 THEORETICAL MATHEMATICS

Includes topology and number theory.

N79-29939 Utah Univ., Salt Lake City.
TOWARD A MATHEMATICAL THEORY OF PERCEPTION Ph.D. Thesis
James Thomas Kajiya 1979 219 p
Avail: Univ. Microfilms Order No. 7914081

A technique for the modelling of perceptual systems called formal modelling is developed. These techniques are used to study the brightness perception mechanism of the human visual system. Several visual groups are defined and their corresponding structures for visual system models are obtained. Mandala transform deduced from a certain visual group, and its implications for image processing are discussed. Image processing algorithms suggested by the model are used to process a real world image for enhancement and for form and texture extraction. Dissert. Abstr.

N79-29940 Indiana Univ., Indianapolis.
A NEW CLASS OF ROTATOR MODELS FOR STATISTICAL MECHANICS AND A GENERALIZATION OF LIEB'S THEOREM Ph.D. Thesis
William Roger Fuller 1979 100 p
Avail: Univ. Microfilms Order No. 7916912

A mathematical generalization of the concept of quantum spin is developed. In the standard theory the spin operators form a Lie algebra isomorphic to that of the generators of the group of representations in three dimensions. The generalization proposed takes for the Lie algebra of spin operators the generators of the n-dimensional rotation group. A proof of a generalized Wigner-Eckart theorem and its application to generalized quantum spin models is presented. The application to quantum spins is developed by specifying the form of a model Hamiltonian on a product of Hilbert spaces, by obtaining representation functions for the Hamiltonian, and by deriving bounds for the quantum partition function. Dissert. Abstr.

N79-29941 University of South Florida, Tampa.
PASSIVITY FOR NONLINEAR EVOLUTION IN BANACH SPACES Ph.D. Thesis
Jorge Toro Gonzalez 1979 68 p
Avail: Univ. Microfilms Order No. 7917100

Let X be a real Banach space with uniformly convex dual X^* and J a real interval. The passivity and alpha-passivity alpha (less than 0) are studied as defined in the Systems Theory of nonlinear evolution equations of the form X prime $+A(t)x=f(t)$ where the operators A(t):X approaches X, t, where point t belongs to set J, and are assumed to have domain D(A(t) independent of t and be at least m-accretive for each t where point t belongs to set J. The function f is assumed at least locally in the sense of Bochner. In case A(t) independent of t, using the existence and uniqueness theorem of Benilan, the concept of i-passivity and i alpha passivity for Benilan solutions is introduced. The main result in this direction shows that Equation (E) is i alpha-passive if and only if A is alpha-accretive and satisfies some kind of hemicontinuity with D(A) convex. Dissert. Abstr.

N79-29942 Washington Univ., Seattle.
REDUCTIVE ISOMETRY GROUPS OF HOMOGENEOUS RIEMANNIAN MANIFOLDS Ph.D. Thesis
Carolyn Sue Gordon 1979 63 p
Avail: Univ. Microfilms Order No. 7918597

The problem of describing the structure of the full isometry group A of a connected homogeneous Riemannian manifold M in terms of a given transitive subgroup G of A which satisfies prescribed structural conditions is considered. The main theorem asserts that if G is reductive and the connected components of its center are compact, then A is reductive and the product of all the noncompact simple normal subgroups of G coincides with the analogously defined subgroup of A. In particular, when G is semisimple of the noncompact type, i.e. all simple normal subgroups of G are noncompact, G is a normal subgroup of A. In this case a method is given to construct A from knowledge of G and the action of G on M. When G is semisimple and the action of G on M is simply transitive, it is shown that G is locally isomorphic to a transitive normal subgroup G prime of A. If G satisfies the additional hypothesis of simple-connectivity, G prime is isomorphic to G and also acts simply transitively on M. Dissert. Abstr.

N79-29943 Fordham Univ., New York, N. Y.
ANALYTIC INDEPENDENCE OF VECTORS IN HILBERT SPACE Ph.D. Thesis
Vadakepattaniyil Thomas Alexander 1979 54 p
Avail: Univ. Microfilms Order No. 7918266

Let U sub m be the unilateral shift of multiplicity one. A complete characterization of the cyclic vectors of U sub m, the adjoint of U sub m , is obtained. Pairs of logmodular functions in L sq (m) which are jointly cyclic for the bilateral shift W sub m are characterized. It is also shown that the unilateral shift of any finite multiplicity is a quasiaffine transform of W sub m. A concept called analytic independence of vectors was developed to obtain these results. The same concept is again used to obtain necessary and sufficient conditions for a contraction to be quasisimilar to the unilateral shift of any finite multiplicity. The notion of effectually rational cyclicity was studied. It is shown that quasisimilarity preserves the order of effectually rational cyclicity. Dissert. Abstr.

N79-29944 Washington Univ., Seattle.
THE EXTENDED POWER CONSTRUCTION AND COHOMOTOPY Ph.D. Thesis
Clifford Robert Cooley 1979 88 p
Avail: Univ. Microfilms Order No. 7917547

An Adams spectral sequence for cohomotopy is described. A differential complex for computing the E2 term of this spectral sequence using the lambda algebra of Curtis is given. A spectral sequence analogue of the Puppe sequence using filtration shifts is given along with calculation of filtration shifts using differentials. The basic facts about the extended power construction is described. Some results of Adams and others about the attaching maps in stable real projective space are summarized. A formula for the Hopf invariant of the extended power of a map in the metastable range is given along with some formulas for compositions of extended powers with elements in the homotopy of spheres. The squaring operations in the cohomology of the Steenrod algebra to detect extended powers in the Adams spectral sequence for cohomotopy are used. Dissert. Abstr.

N79-29945 Yale Univ., New Haven, Conn.
WEAKLY NULL NORMALIZED SEQUENCES IN BANACH SPACES Ph.D. Thesis
John Hancock Elton 1978 72 p
Avail: Univ. Microfilms Order No. 7915816

A general method for constructing weakly null normalized bases is considered. The example of a weakly null normalized sequence with no unconditional subsequence is discussed in this framework. The fact that their subsequence is weakly null is shown to follow from these general considerations. A sufficient condition for the existence of an unconditional subsequence is given, and it is related to a result showing that a weakly null sequence of characteristic functions in infinity (s) has an unconditional subsequence. Dissert. Abstr.

N79-29946 Florida State Univ., Tallahassee.
PROPERTIES OF ORDER-DEFINED AND OTHER INTRINSIC TOPOLOGIES IN ORDERED VECTOR SPACES Ph.D. Thesis
Nancy Jo Fordyce 1978 91 p
Avail: Univ. Microfilms Order No. 7917042

Let (X,K) be an Archimedean ordered vector space in which the positive cone, K, is generating. The relative uniform topology, T sub r, has as its closed sets those that are closed under relative uniform (ru-) convergence of sequences. It is observed that, in this setting, the T sub r -neighborhoods of any point in X are precisely the translates of the T sub r-neighborhoods of theta to the point. Thus, to describe the relative uniform topology T sub r, it suffices to describe the T sub r-neighborhoods of theta. It is shown that the diagonal property for relative uniform convergence holds in (X,K) if and only if every subset U of X that absorbs order bounded sets is a T sub r-neighborhood of theta. This characterization of diagonal property is used for ru-convergence to show that in spaces in which it holds, there is a neighborhood basis at theta for T sub r whose elements are unions of order intervals. Thus, in these spaces scalar multiplication is always T sub r-continuous. Dissert. Abstr.

N79-29947 Indiana Univ., Bloomington.
SUBNORMAL OPERATORS, TOEPLITZ OPERATORS, AND THE SPECTRAL INCLUSION THEOREM Ph.D. Thesis
Gerard Eugene Keough 1979 98 p
Avail: Univ. Microfilms Order No. 7916891

The interplay between two spectral inclusion theorem is addressed. First, a result of Hartman and Wintner states that the spectrum of every Laurent operator is contained inside that of its associated Toeplitz operator. Second, Halmos showed that the spectrum of every subnormal operator contains that of its minimal normal extension. A framework in which to examine the Hartman-Wintner result in terms of the Halmos result in terms of the Halmos result is constructed. Dissert. Abstr.

N79-29948 Missouri Univ. -Kansas City.
CYCLIC ELEMENT THEORY IN PARASEPARABLE CONNECTED HAUSDORFF SPACES Ph.D. Thesis
David Arthur John 1979 41 p
Avail: Univ. Microfilms Order No. 7918412

The space M is paraseparable if and only if M does not contain uncountably many disjoint open sets. Two points a and b of a connected space M are conjugate if and only if no point of M separates a from b in M. If M is a connected space, point p belongs to the set M, and p is neither a cut point nor an end point of M, then the set consisting of p and all points of M conjugate to p is called the simple link of M generated by p. If E is a nondegenerate connected subset of the connected space M such that E has no cut point and is not a subset of any other connected subset of M having no cut point, then E is called an E sub o set in M. In paraseparable semi-locally connected continua, the simple links of M and the E sub o sets of M are identical; they are called cyclic elements of M. This work is concerned with four main subjects: characterizing abcohesive spaces and applying this property to connected spaces, establishing that locally compact connected spaces have nondegenerate simple links, generalizing many of the known theorems on A-sets to nonmetric and nonlocally connected spaces and establishing sufficient conditions for the existence of nodal sets that do not separate the space, and answering some questions concerning dendritic spaces. Dissert. Abstr.

N79-29949# Wisconsin Univ. - Madison. Mathematics Research Center.
CRITICAL POINT THEOREMS FOR INDEFINITE FUNCTIONALS
Vieri Benci and Paul H. Rabiowitz Feb. 1979 33 p refs
(Contracts DAAG29-75-C-0024; N00014-76-C-0300)
(AD-A068867; MRC-TSR-1927) Avail: NTIS
HC A03/MF A01 CSCL 12/1

A variational principle of a minimax nature is developed and used to prove the existence of critical points of certain variational problems which are indefinite. The proofs are carried out directly in an infinite dimensional Hilbert space. Special cases of these problems previously had been tractable only by an elaborate finite dimensional approximation procedure. The main applications given here are to Hamiltonian systems of ordinary differential equations where the existence of time periodic solutions is established for several classes of Hamiltonians. GRA

N79-29950# Wisconsin Univ. - Madison. Mathematics Research Center.
LJUSTERNIK-SCHNIRELMAN THEORY ON GENERAL LEVEL SETS
Eberhard Zeidler Jan. 1979 26 p refs
(Contract DAAG29-75-C-0024)
(AD-A068932; MRC-TSR-1910) Avail: NTIS
HC A03/MF A01 CSCL 12/1

Let a,b be functionals on a real Banach space X. The eigenvalue problems for nonlinear elliptic partial differential equations where the principal elliptical part is indefinite, and with Hammerstein integral equations where the kernel has eigenvalues of different signs are considered. The main abstract theorems in Section 5 provide a general formulation of the Ljusternik-Schnirelman theory in Banach spaces in the constrained case. GRA

N79-29951# Wisconsin Univ. - Madison. Mathematics Research Center.
REMARKS ON GENERATORS OF ANALYTIC SEMIGROUPS
M. G. Crandall, A. Pazy, and L. Tarter Jan. 1979 19 p ref
(Contract DAAG29-75-C-0024; Grant NSF MCS-78-01245)
(AD-A068934; MRC-TSR-1912) Avail: NTIS
HC A02/MF A01 CSCL 12/1

This paper contains two new characterizations of generators of analytic semigroups of linear operators in a Banach space. These characterizations do not require use of complex numbers. One is used to give a new proof that strongly elliptic second order partial differential operators generate analytic semigroups in L superscript p, 1 - p - infinity, while the sufficient condition in the other characterization is meaningful in the case of nonlinear operators. GRA

70 PHYSICS (GENERAL)

For geophysics see *46 Geophysics*. For astrophysics see *90 Astrophysics*. For solar physics see *92 Solar physics*.

N79-29952 Michigan Univ., Ann Arbor.
SPHERICALLY SYMMETRIC FLUID SPHERES IN GENERAL RELATIVITY Ph.D. Thesis
Selcuk Sukru Bayin 1979 79 p
Avail: Univ. Microfilms Order No. 7916664

Techniques are presented for solving field equations of spherically symmetric objects in general relativity and constructing analytic stellar models. Topics discussed include field equations for static and rotating fluid spheres, time-dependent equations for radiating fluid spheres, and equations of state at ultrahigh densities and the speed of sound. The assumption that phonons follow null geodesic lines is examined, and expanding and contracting fluid spheres are considered. Dissert. Abstr.

N79-29953# Argonne National Lab., Ill.
USES OF PULSED NEUTRON SOURCES FOR RESEARCH IN MAGNETISM AND OTHER AREAS OF CONDENSED MATTER PHYSICS
S. K. Sinha 1978 26 p refs Presented at 24th Conf. on Magnetism and Magnetic Materials, Cleveland, Ohio, 14 Nov. 1978
(Contract W-31-109-eng-38)
(CONF-781114-12) Avail: NTIS HC A03/MF A01

A conceptual introduction to pulsed spallation neutron sources for condensed matter is given. Neutron time-of-flight techniques as applied to diffraction and inelastic neutron scattering spectroscopy are discussed, and compared with techniques using crystal spectrometers. The advantages of such sources such as high effective thermal and higher energy neutron fluxes for certain kinds of experiments are discussed. The applications of these sources to various areas of condensed matter research are reviewed, with special emphasis on the study of magnetism. Finally, a brief account is given of the status of pulsed spallation source development around the world. DOE

71 ACOUSTICS

Includes sound generation, transmission and attenuation.

For noise pollution see *45 Environment Pollution*.

N79-29954 American Univ., Washington, D. C.
SCATTERING OF ACOUSTIC WAVES FROM RANDOMLY ROUGH SURFACES Ph.D. Thesis
Susan Kathleen Numrich 1979 101 p
Avail: Univ. Microfilms Order No. 7916857

Sound scattered in the specular directions by fixed rough surfaces was examined using three experimental methods. Schlieren visualization provided a photographic image of the entire scattered field. Measurements of the sound returned in the specular direction were made using a transient pulse analysis scheme. These values were confirmed by means of steady state pulse analysis, the more traditional experimental approach. Using the Rayleigh roughness parameter as a normalizing factor, comparisons were made with existing experimental results and theoretical models. In the region of small roughness, the new data agreed with both theory and prior experiment. This experiment extended measurements beyond Rayleigh roughness of 3, which had been the limit of recent investigation, to very high values of roughness (20 and beyond). Simultaneous measurements of the coherent and total reflection coefficients were made for the first time. Dissert. Abstr.

N79-29955 Washington Univ., Seattle.
ON ELECTRICAL EQUALIZATION OF PIEZOELECTRIC TRANSDUCERS TO OBTAIN OPTIMAL POWER TRANSFER AND SHORT ACOUSTIC BURSTS Ph.D. Thesis
Larry Joseph Augustine 1979 201 p
Avail: Univ. Microfilms Order No. 7917534

A method of designing an equalizer to match the transducer to a specified source resistance without the use of transformers is developed and the relationship between the mechanical forces generated and electrical excitation voltages for matched transducers are determined. The particular case where the transducer is to be matched to an ideal source with a lossless equalizer is considered. Constraints are found to exist on the location of the critical frequencies of the driving point impedance of circuits consisting of transducers embedded in lossless elements. Dissert. Abstr.

N79-29956*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
METHOD AND APPARATUS FOR SHAPING AND ENHANCING ACOUSTICAL LEVITATION FORCES Patent Application
William A. Oran, LeRoy H. Berge, Donald A. Reiss, and Jerry L. Johnson, inventors (to NASA) Filed 13 Jul. 1979 12 p
(NASA-Case-MFS-25050-1; US-Patent-Appl-SN-057466) Avail: NTIS HC A02/MF A01 CSCL 20A

A method and apparatus for enhancing and shaping acoustical levitation forces in a single-axis acoustic resonance system is described. Specially shaped drivers and reflectors are utilized to enhance the levitation force and better contain fluid substances by means of field shaping. NASA

N79-29957*# Southwest Research Inst., San Antonio, Tex.
ENGINE-INDUCED STRUCTURAL-BORNE NOISE IN A GENERAL AVIATION AIRCRAFT
James F. Unruh, Dennis C. Scheidt, and Daniel J. Pomerening Aug. 1979 123 p refs
(Contract NAS1-14861; SwRI Proj. 02-4860)
(NASA-CR-159099) Avail: NTIS HC A06/MF A01 CSCL 20A

Structural borne interior noise in a single engine general aviation aircraft was studied to determine the importance of engine induced structural borne noise and to determine the necessary modeling requirements for the prediction of structural borne interior noise. Engine attached/detached ground test data show that engine induced structural borne noise is a primary interior noise source for the single engine test aircraft, cabin noise is highly influenced by responses at the propeller tone, and cabin acoustic resonances can influence overall noise levels. Results from structural and acoustic finite element coupled models of the test aircraft show that wall flexibility has a strong influence on fundamental cabin acoustic resonances, the lightweight fuselage structure has a high modal density, and finite element analysis procedures are appropriate for the prediction of structural borne noise. A.W.H.

N79-29958*# Kansas Univ. Center for Research, Inc., Lawrence.
THE EFFECT OF OBLIQUE ANGLE OF SOUND INCIDENCE, REALISTIC EDGE CONDITIONS, CURVATURE AND IN-PLANE PANEL STRESSES ON THE NOISE REDUCTION CHARACTERISTICS OF GENERAL AVIATION TYPE PANELS Progress Report
Ferd Grosveld, Jaap Lameris, and David Dunn Jul. 1979 134 p refs
(Grant NsG-1301)
(NASA-CR-157452; KU-FRL-417-10) Avail: NTIS HC A07/MF A01 CSCL 20A

Experiments and a theoretical analysis were conducted to predict the noise reduction of inclined and curved panels. These predictions are compared to the experimental results with reasonable agreement between theory and experiment for panels under an oblique angle of sound incidence. Theoretical as well as experimental results indicate a big increase in noise reduction when a flat test panel is curved. Further curving the panel slightly decreases the noise reduction. Riveted flat panels are shown to give a higher noise reduction in the stiffness-controlled frequency region, while bonded panels are superior in this region when the test panel is curved. Experimentally measured noise reduction characteristics of flat aluminum panels with uniaxial in-plane stresses are presented and discussed. These test results indicate an important improvement in the noise reduction of these panels in the frequency range below the fundamental panel/cavity frequency. A.W.H.

N79-29959# Washington Univ., Seattle. Applied Physics Lab.

ENVIRONMENTAL ASPECTS OF A NORTH PACIFIC ACOUSTIC FIXED-SOURCE, FIXED-RECEIVER INSTALLATION Technical Report, 1 Mar. 1977 - 1 Mar. 1979

Morris Schulkin 1 Mar. 1979 100 p refs
(Contract N00014-77-C-0309)
(AD-A068187; APL/UW-7905) Avail: NTIS HC A05/MF A01 CSCL 20/1

The Office of Naval Research (Code 222) is sponsoring an experimental program in the Northeast Pacific Ocean to investigate long-term variations in propagation loss and travel time between a fixed source and fixed receiver over extremely long paths. This report considers environmental factors which are expected to be important for acoustic modeling and prediction, particular attention being given to mesoscale features, or 'ocean weather'. Existing and planned environmental data sources and formats are reviewed in terms of the requirements. Cost-effectiveness is emphasized. Monthly weeklong shallow XBT (480 m) sampling of the 3835-km Oahu to San Francisco path by the National Marine Fisheries Service (NOAA) ship-of-opportunity program is found to serve well as a basis. However, the sampling depth must be increased beyond the sound channel axis at about 800 m, and the spacing of drops should be reduced to about 30 km in the vicinity of sharp temperature and salinity gradients. A program has been implemented to merge the taped historical oceanographic station data file (NAVOCEANO) with synoptic XBT and salinity data (NMFS). Available bathymetric (NORDA) and M sub 2 tidal (NSWC) data banks appear to be quite satisfactory. GRA

N79-29960# Utah Univ., Salt Lake City. Dept. of Computer Science.

APPLICATION OF ADAPTIVE NOISE CANCELLATION TO NOISE REDUCTION IN AUDIO SIGNALS

Dennis Carl Pulsipher Mar. 1979 72 p refs
(Contract N00173-77-C-0041)
(AD-A068428; UTEC-CSC-79-022) Avail: NTIS HC A04/MF A01 CSCL 20/1

The LMS Adaptive Noise Cancellation algorithm has been applied to the removal of high-level white noise from audio signals. Simulations and actual acoustically recorded signals have been processed successfully, with excellent agreement between the results obtained from simulations and the results obtained with acoustically produced data. A study of the filter length required in order to achieve a desired noise reduction level in a hard-walled room is presented. The performance of the algorithm in this application is described and required modifications are suggested. A multichannel processing scheme is presented which allows the adaptive filter to converge at independent rates in different frequency bands. This is shown to be of particular use when the interfering noise is not white. Careful implementation of the scheme allows the problem to be broken into several smaller ones which can be handled by independent processors, thus allowing longer filter lengths to be processed in real time. GRA

N79-29961# Weapons Systems Research Lab., Adelaide (Australia).

A RAY TRACING MODEL FOR PROPAGATION LOSS CALCULATIONS

D. V. Wyllie Aug. 1978 20 p
(AD-A068375; WSRL-0035-TM) Avail: NTIS HC A02/MF A01 CSCL 20/1

A brief description is given of a ray tracing model developed for making propagation loss predictions for use in underwater acoustic research. A range independent sound speed profile and ocean depth are assumed. The various options available to the user are discussed together with some results, which highlight the importance of having available good bottom loss versus grazing angle data. A FORTRAN computer program is currently available for use on the IBM 370/168 at Defence Research Center Salisbury. GRA

N79-29962# Massachusetts Inst. of Tech., Cambridge. Fluid Dynamics Research Lab.

PARAMETRIC STUDIES OF MODEL HELICOPTER BLADE SLAP AND ROTATIONAL NOISE Final Technical Report

James E. Hubbard, Jr., N. G. Humbad, Paul Bauer, and Wesley L. Harris Feb. 1979 93 p refs
(Contract DAAG29-76-C-0027)
(AD-A068181; ARO-12931.1-EX; Rept-79-1) Avail: NTIS HC A05/MF A01 CSCL 20/1

A parametric study of model helicopter rotor blade slap due to blade/vortex interaction was studied in an anechoic wind tunnel. The parameters studied were blade number, advance ratio, pitch, and shaft angle. The separate effect of each parameter was studied with other parameters held fixed. The intensity of blade slap was found to decrease with an increase in the number of blades, as the advance ratio was increased to a maximum and then decreased with higher advance ratios indicating a blade slap envelope. The intensity of blade slap was observed to be directly proportional to pitch. The intensity increased with increasing pitch until unsteady lift was encountered, at which time the intensity rapidly diminished. As the rotor shaft angle was increased, the intensity of blade slap was found to decrease to a condition of no blade slap. Directivity measurements were made of blade slap due to blade/vortex interaction in the plane normal to the tunnel wind axis. No blade slap was encountered at the intersection of the rotor disc plane and the plane normal to the tunnel wind axis. The first indication of blade slap occurred at 30 deg below the rotor disc plane and increased in intensity, reaching a maximum intensity at 90 deg below the rotor. In all studies the presence of blade slap was determined subjectively by observing and listening to the transient acoustic signature. GRA

N79-29963# Bolt, Beranek, and Newman, Inc., Canoga Park, Calif.

NOISEMAP 3.4 COMPUTER PROGRAM OPERATOR'S MANUAL Final Report

Jane M. Beckmann and Harry Seidman Wright-Patterson AFB, Ohio AMRL Dec. 1978 308 p refs
(Contract F33615-76-C-0528; AF Proj. 7231)
(AD-A068518; AMRL-TR-78-109) Avail: NTIS HC A14/MF A01 CSCL 09/2

The NOISEMAP computer program was developed to calculate community noise exposure from aircraft operations. This report documents the steps necessary to prepare data for using the current version, NOISEMAP 3.4. Allowable card sequences are identified and examples are given. Each permissible card type is formally defined and discussed. A companion computer program, DATASCREEN, was previously developed to aid in the checking of the NOISEMAP input deck. The special features of DATASCREEN are identified including a summary of operations that is produced. GRA

N79-29964# Bolt, Beranek, and Newman, Inc., Canoga Park, Calif.

HELICOPTER NOISE LEVEL FUNCTIONS FOR USE IN COMMUNITY NOISE ANALYSES Final Report

William J. Galloway AMRL Wright-Patterson AFB, Ohio Jan. 1979 49 p refs
(Contract F33615-76-C-0528)
(AD-A068455; BBN-3713; AMRL-TR-78-87) Avail: NTIS HC A03/MF A01 CSCL 01/3

Acoustical data obtained from helicopters in level flight and during 6 degree approaches are used to obtain the variation of A-weighted sound exposure level and effective perceived noise level with distance. These functions are normalized to a reference airspeed which differs for individual helicopter types. Sound level functions at airspeeds different from the reference airspeed, either higher or lower, are obtained by adding a decibel increment to the reference functions. This increment is obtained by multiplying a constant, different for each helicopter, times the square of the difference between the airspeed of interest and the reference airspeed. These data are provided for the following aircraft: CH-3C, CH-47C, CH-54B, HH-53B/C, OH-6A, TH-55A, UH-1N, UH-13. Maximum A-weighted sound levels and perceived noise levels at a distance of 76 meters (250 feet) are also provided as a function of angle around the aircraft during stationary hover conditions. GRA

N79-29965# Idaho National Engineering Lab., Idaho Falls.

ULTRASONIC DENSITY DETECTOR AIR-WATER FLOW TEST

A. E. Arave 23 Jan. 1979 75 p refs
(Contract EY-76-C-07-1570)
(LTR-141-91) Avail: NTIS HC A04/MF A01

An ultrasonic density detector was developed for measurement of two-phase media densities in the Loss-of-Fluid Test effects in the semiscale air-water flow loop. Test procedure and results are outlined. Analysis of the data shows the expected flow effects in terms of flow regime. DOE

72 ATOMIC AND MOLECULAR PHYSICS

Includes atomic structure and molecular spectra.

N79-29966 British Library Lending Div., Boston Spa (England).
SECONDARY CHARGED PARTICLE FLUX DISTRIBUTION IN THE CELL OF AN ION SOURCE ION-OPTICAL SYSTEM
V. G. Grigoryan, L. A. Latyshev, V. A. Obukhov, A. A. Panasenkov, and N. N. Semashko Feb. 1979 25 p refs Transl. into ENGLISH of Rept. IAE-3024 from Kurchatov Inst. of Atomic Energy, Moscow, 1978
(BLL-CTO-1587-(9091.9F)) Avail: British Library Lending Div., Boston Spa, Engl.

The motion of secondary ions formed inside the ion optical system of an ion source as a result of charge exchange and ionization is analyzed along with the motion of electrons formed by ion electron emission at the acceleration electrode. An electrolytic integrator is used to plot the charged particle trajectories and to determine the thermal flux distributions over the electrodes. It is shown that the electrode configuration and the profile of the secondary plasma boundary near the output electrode influence the thermal load distribution over the electrodes. K.L.

N79-29967 Tennessee Univ., Knoxville.
ELECTRON CAPTURE TO CONTINUUM STATES OF BARE PROJECTILE IONS Ph.D. Thesis
Charles Randall Vane 1979 137 p
Avail: Univ. Microfilms Order No. 7918657

Relative cross sections for electron capture to continuum states by bare projectile ions H(+), C(+6), O(+8), and Si(+14) were measured for beam energies between 0.70-3.86 MeV/u with helium, neon, and argon targets. The relative cross sections were made absolute by linking them to recently published absolute cross sections from several other sources. The projectile charge and velocity dependences of these cross sections, as well as the experimentally observed shape of the forward electron peak which arises from electron capture to continuum processes were studied and compared with predictions from several theoretical treatments. The absolute cross sections found for 0.7-2.0 MeV H(+) on neon and argon are consistent with those measured elsewhere for 0.7-1.7 MeV/u H(+) incident on the same targets. Dissert. Abstr.

N79-29968 Indiana Univ., Indianapolis.
CHARACTERIZATION AND EXAMINATION OF THE HELIUM-OXYGEN-ACETYLENE FLAME AS AN ATOM CELL FOR ATOMIC SPECTROMETRIC ANALYSIS Ph.D. Thesis
Kathy Ann Saturday 1979 201 p
Avail: Univ. Microfilms Order No. 7916924

A thorough investigation of the helium-oxygen-acetylene flame was undertaken. An examination of the physical characteristics of the flame indicated its potential applicability to practical atomic spectrometry. Modifications in burner design and designation of safe operating limits stabilized the flame, whereas Schlieren photographs revealed the high degree of flame laminarity. A maximum flame temperature of 2800 K was measured using the sodium line reversal technique. The flame background emission spectrum, while more intense than that from a conventionally used air-acetylene flame, is relatively unstructured compared to the emission of a nitrous oxide-acetylene flame, another commonly employed mixture. Dissert. Abstr.

N79-29969 Washington Univ., Seattle.
SEARCH FOR A PARITY NON-CONSERVING OPTICAL ROTATION IN ATOMIC BISMUTH Ph.D. Thesis
Lindon L. Lewis 1978 190 p
Avail: Univ. Microfilms Order No. 7917596

A search for a parity non-conserving (PNC) optical rotation was made with a sensitivity sufficient to test recent predictions of such effects, based upon the Weinberg-Salam (W-S) model of weak neutral currents (WNC). According to atomic predictions using the W-S model, a dispersive rotation of plane polarized light which passes through atomic bismuth vapor should occur as the wavelength of the light is tuned across each hyperfine component of the 8757 A magnetic dipole transition. An exhaustive description of an experiment to measure this effect is given. A recently developed narrow linewidth (GaAl)As diode laser is used as a light source in this experiment. Details are presented of the operation of the laser diode in this application. The absorption and Faraday rotation curves as measured by this method are compared with theoretical predictions. The method of data analysis employed is also discussed. Dissert. Abstr.

N79-29970 Nebraska Univ. - Lincoln.
THE CONVERSION OF ALIGNMENT OF ORIENTATION IN A MAGNETIC FIELD Ph.D. Thesis
Fredrick Wilbur Nehring 1979 99 p
Avail: Univ. Microfilms Order No. 7918018

The conversion for the 2p3P, 3p3P, and 3d3D multiplets of helium have been calculated. By expanding the density matrix into the irreducible tensor components of orientation and alignment operators, the calculation expresses orientation and alignment as an initial value problem. For the three multiplets as much as 2% orientation results from initial alignment. An experiment is proposed to measure this effect. Dissert. Abstr.

N79-29971 College of William and Mary, Williamsburg, Va.
STUDIES OF NEGATIVE ION-ATOM SCATTERING AT LOW COLLISION ENERGIES Ph.D. Thesis
Barry Thomas Smith 1978 114 p
Avail: Univ. Microfilms Order No. 7918473

The threshold behavior of the absolute total electron detachment cross section for collisions of Cl(-) with He, Ne, Ar, Kr, H2, D2, O2, N2, CO and CO2 was determined in an ion beam-gas target apparatus. The measurements were completed over a relative energy range from below the electron affinity of Cl(-) to approximately 150 eV. It was found the threshold for detachment is about twice the electron affinity of chlorine. Relative elastic inelastic differential cross sections were measured for collisions of Cl(-) with O2, N2, CO and CO2. The experiments are discussed within the framework of a local complex potential model. Dissert. Abstr.

N79-29972 Maryland Univ., College Park.
THE ELECTROMAGNETIC FORM FACTORS OF COMPOSITE SYSTEMS Ph.D. Thesis
Edward Joseph Nowak 1978 111 p
Avail: Univ. Microfilms Order No. 7917388

Electromagnetic form factors are examined for a spin-zero, two-body composite system with emphasis on the case of small momentum transfer and/or deep (relativistic) binding. Perturbation theory calculations are performed using spin-zero and then spin-one-half constituents. A dispersion representation of the bound-state vertex function is conjectured first for scalar and then for fermion constituents. A relativistic effective range approximation was developed for each case and then applied to the calculation of the electromagnetic form factor. Dissert. Abstr.

N79-29973 Stanford Univ., Calif.
DEPOLARIZED RAYLEIGH SCATTERING STUDIES OF THE ROTATIONAL MOTION OF SMALL MOLECULES AND POLYMERS, AND OF LATTICE MODEL POLYMER CHAINS Ph.D. Thesis
Craig William Cornelius 1979 149 p
Avail: Univ. Microfilms Order No. 7917218

The depolarized Rayleigh scattering from flexible polymer chains of several lengths on the tetrahedral lattice were simulated with Monte Carlo methods. Autocorrelation functions were calculated for the depolarized light scattering of unsubstituted chains and also for chains including simple substituents attached

to the chain backbone. Differences were observed in the relative intensities of the relaxation components, which depend on the tacticity of the chain. The depolarized Rayleigh scattering of several small molecules in solution were also studied by Fabry-Perot interferometry. The reorientation rate of diphenyl methane in solution was also studied. The reorientation times of bis(2-hydroxyphenyl) methane and bis(4-hydroxyphenyl)methane in dioxane solution at several concentrations were determined. Three narrow molecular weight fractions of polymethylmethacrylate and one high molecular weight sample of polyalphamethylstyrene were studied. Dissert. Abstr.

N79-29974 Michigan Univ., Ann Arbor.
MOLECULAR STRUCTURES OF SULFUR HEXAFLUORIDE, TRI-TERT-BUTYLSILANE AND TRIS(TRIMETHYLSILYL) SILANE BY ELECTRON DIFFRACTION Ph.D. Thesis
Stephen Kunshen Doun 1979 110 p
Avail: Univ. Microfilms Order No. 7916697

The S-F bond length of 1.561(2) A at room temperature was determined with an accuracy an order of magnitude better than that previously reported. Listed uncertainties are 3 sigma. The molecular structure of SF6 at elevated temperatures were also studied and significant lengthenings of the S-F bond and increases in the mean-square amplitudes of vibration were observed. The customarily invoked equation based on Morse anharmonicity is not sufficient to account for the full increase in bond length with increase in amplitudes of vibration. Bond lengths for tri-tert-butylsilane and tris(trimethylsilyl)silane, calculated with a silane model force field, were compared with those of tri-tert-butylmethane, di-tert-butylmethane, tri-tert-butylphosphine and tetrakis(trimethylsilyl)silane. Dissert. Abstr.

N79-29975 California Univ., Davis.
NMR STUDIES OF PI MOLECULAR COMPLEXES IN IRON PORPHYRINS Ph.D. Thesis
Ahmad Toufik Kabbani 1979 143 p
Avail: Univ. Microfilms Order No. 7917162

Proton and carbon-13 NMR shifts and linewidths of a series of synthetic high-spin ferric porphyrin were investigated upon the addition of various aromatic pi acceptors and donors. The interactions are described by the formation of 1:1 adducts. Thermodynamics of the complex chloro(Tetraphenylporphyrin)-iron (3)/1,3,5-trinitrobenzene are indicative of pi-pi peripheral contact of the aromatic substrate with the porphyrin. Successful use of NMR was made to demonstrate the utility of intramolecular dipolar relaxation, induced at proton and carbon-13 of trinitrobenzene resonance by the ferric ion, in the determination of the solution structure of the pi molecular complex chloro (tetraphenylporphyrin) iron(3)/1,3,5-trinitrobenzene.
Dissert. Abstr.

N79-29976 Washington Univ., Seattle.
THE MOLECULAR AND ELECTRONIC STRUCTURE OF IMINAMINO RADICALS Ph.D. Thesis
Roy Leon Lewis, Jr. 1979 127 p
Avail: Univ. Microfilms Order No. 7918605

To ascertain the effects of the steric and electronic properties of various substituent groups in determining the total molecular and electronic structure of iminamino radicals, R2R3C=N-N-R1, ESR spectra of several radicals containing a variety of substituents (alkyl, acetyl, phenyl, 2,4-dinitrophenylphenyl, and silyl) were observed. One cyclic radical(from 3,5,5-trimethylpyrazoline), which can formally be viewed as an iminamino radical also was detected. The g-factors of the radicals were computed, and the nitrogen hyperfine coupling constants were assigned. Based on the ESR data, the radicals were assigned either a sigma or pi structure.
Dissert. Abstr.

N79-29977 Virginia Univ., Charlottesville.
MATRIX ISOLATION SPECTROSCOPIC STUDIES OF NEW INTER-HALOGEN SPECIES AND OF GROUP II METAL-OZONE REACTION PRODUCTS Ph.D. Thesis
Eleanor Steinback Prochaska 1978 179 p
Avail: Univ. Microfilms Order No. 7916319

The trapping of reactive species in inert solid argon or nitrogen, known as the matrix isolation technique, allows these species to be maintained and observed over reasonable periods of time. The new species observed in these studies are of the type that cannot be readily studied in the gas or solid phase due to their instability or reactivity. A number of chemical systems recently investigated by this technique are described. Dissert. Abstr.

N79-29978 Michigan Univ., Ann Arbor.
OPTICAL EMISSION AND LASER EXCITATION SPECTRA OF NIOBIUM NITRIDE Ph.D. Thesis
Nancy Louise Ranieri 1979 144 p
Avail: Univ. Microfilms Order No. 7916799

The electronic emission and laser excitation spectra of diatomic niobium nitride were investigated in the visible region of the electromagnetic spectrum. Altogether, eight molecular bands comprising five band systems were studied. The niobium nitride spectra are also characterized by pronounced hyperfine structure which arises from a coupling between the electronic magnetic moment and the magnetic moment of the niobium nucleus (I = 9/2). Analysis of these hyperfine effects is a very important consideration in assigning molecular electronic states and configurations. The 5582 A and 5137 A transitions both exhibit predissociation in the upper state. The laser-induced fluorescence spectrum of the 3 phi sub 2 - 3 Delta sub 1 transition was obtained, and establishes the electronic ground state as 3 Delta sub 1. Dissert. Abstr.

N79-29979 Minnesota Univ., Minneapolis.
APPLICATIONS OF NUCLEAR MAGNETIC RESONANCE QUADRUPOLE PROBES TO THE STUDY OF PROTEIN BINDING SITES FOR IONS AND SMALL MOLECULES Ph.D. Thesis
Kenneth Dale Rose 1979 297 p
Avail: Univ. Microfilms Order No. 7918388

The longitudinal and transverse NMR relaxation rates were measured for chloride, perchlorate, and sodium ions interacting with the ion binding sites of human serum albumin and other proteins. Oxygen-17 transverse relaxation rates are reported in solutions of a diamagnetic zinc metalloenzyme, bovine carbonic anhydrase, and its metal-free derivative. Several experiments are presented using Co-59 and N-14 NMR relaxation in four substitutionally inert cobalt (3) complexes from which the importance of second coordination sphere effects on the cobalt relaxation are estimated are estimated and first coordination sphere effects are quantitatively measured. Dissert. Abstr.

N79-29980 Pittsburgh Univ., Pa.
CONTINUUM SOURCE ATOMIC FLUORESCENCE OF ELEMENTS WITH RESONANCE LINES IN THE FAR ULTRAVIOLET Ph.D. Thesis
Edward Michael Heithmar 1978 131 p
Avail: Univ. Microfilms Order No. 7917473

The feasibility of using continuum source atomic fluorescence as a trace analytical technique for the determination of elements which are excited by radiation below 250 nanometers was studied using as the primary radiation source the EIMAC 300 watt high pressure short arc xenon illuminator. By a combination of a low background atomization system (argon-hydrogen-entrained air flame) with volatile compound formation for sampling, the signal-to-noise ratio was improved by several orders of magnitude. Hydride generation combined with continuum source atomic fluorescence was optimized. Analytical figures of merit were obtained for arsenic, antimony, bismuth, germanium, selenium, and tellurium. Other volatile compounds analyzed by atomic fluorescence included hydrogen sulfide, sulfur dioxide, elemental mercury, and elemental iodine. The atomic fluorescence of sulfur and iodine are the first reported applications to these elements. Molecular fluorescence of I2 was also investigated.
Dissert. Abstr.

N79-29981 State Univ. of New York at Stony Brook.
RESONANT AND CONTINUUM PRODUCTION OF MASSIVE MUON PAIRS IN 400 GeV PROTON-NUCLEUS COLLISIONS Ph.D. Thesis
Daniel Moshe Kaplan 1979 189 p
Avail: Univ. Microfilms Order No. 7916878

Apparatus used, running conditions, backgrounds and corrections to the data are discussed. Results are presented and interpreted in terms of the quark-parton model and quantum chromodynamics (QCD). The production of a new family of narrow muon(+)muon(-) resonances, dubbed T, is observed. Dependence

of the muon-pair cross-section on nucleon number, mass, transverse momentum, and rapidity is presented, and differences in the production dynamics of the resonances and the continuum are emphasized. Various possible interpretations of the T are discussed. Momentum distributions of antiquarks in the nucleon are extracted. The problem of large muon pair transverse momentum is discussed. The spectrum of single muons arising from massive muon-pair production is computed. Dissert. Abstr.

N79-29982*# California Inst. of Tech., Pasadena. W. K. Kellogg Radiation Lab.

SURFACE STICKING PROBABILITIES FOR SPUTTERED ATOMS OF Nb-93 AND Rh-103

Martha Riherd Weller and T. A. Tombrello [1979] 26 p refs (Grants NGR-05-002-333; EY-76-G-03-1305; NSF PHY-76-83685)
(NASA-CR-157449) Avail: NTIS HC A03/MF A01 CSCL 11F

The capture coefficient probabilities for sputtered atoms of Nb-93 and Rh-103 incident on Al2O3 surfaces were measured using the backscattering of MeV heavy ions. In the circumstance where the collecting surface is thickly covered, the sticking probabilities integrated over the energy distribution of sputtered atoms are 0.97 plus or minus 0.01 for Nb-93 and 0.95 plus or minus 0.01 for Rh-103 respectively. In the limit of negligible areal coverage of the collector, the accuracy is less; in this case the sticking probabilities are 0.97 + 0.03 or -0.08 and 0.95 + 0.05 or -0.08. A.R.H.

N79-29983# Indiana Univ. at Bloomington. Dept. of Chemistry.

EXPERIMENTAL STUDIES ON SPATIAL DISTRIBUTIONS OF ATOMS SURROUNDING AN INDIVIDUAL SOLUTE PARTICLE VAPORIZING IN AN ANALYTICAL FLAME Interim Technical Report

C. B. Boss and G. M. Hieftje 25 May 1979 44 p refs Submitted for publication
(Contract N00014-76-C-0838; NR Proj. 051-622)
(AD-A069151; TR-20; ITR-26) Avail: NTIS HC A03/MF A01 CSCL 07/4

An experimental procedure is described which allows the direct, time-resolved investigation of the spatial distribution of analyte atoms surrounding an individual solute particle vaporizing in a laminar flame. In the procedure, the individual atomic clouds are observed spectrometrically as the flame sweeps them past a fixed horizontal viewing region. The spatial intensity profiles so obtained are treated by a spherically symmetric Abel-type series, to provide the radial analyte distribution in each cloud. These measured radial distribution in each cloud. These measured radial distributions are used to experimentally verify a theoretical model, previously described, which convolves the processes of analyte vaporization and diffusion. From measured vaporization rates and least-squares fits to experimental data, effective diffusion coefficients for analyte atoms are determined. The lateral diffusion interference of phosphate on calcium in nitrous oxideacetylene flames is also studied with the new method. It was found that the calcium vaporization rate and not its diffusion coefficient changes with addition of phosphate, causing the observed alteration in spatial distribution. GRA

N79-29984# California Univ., Los Angeles. Dept. of Chemistry.

MAGNETIC FIELD INDUCED CROSS RELAXATION BETWEEN TWO DIFFERENT SPIN TRANSITIONS OF TRIPLET COUMARIN Interim Technical Report

Christina L. Gniazdowski, William M. Pitts, and M. A. El-Sayed 6 Apr. 1979 25 p refs
(Contract N00014-75-C-0602)
(AD-A068712; TR-33) Avail: NTIS HC A02/MF A01 CSCL 07/4

At certain magnetic fields, when the energy separations between the tau(x) - tau(y) spin levels and between the tau(y) - tau(z) levels of triplet coumarin become equal, intensity changes are observed in the phophorescence of coumarin doped in a single crystal of durene cooled to 1.6 K that can be attributed to cross relaxation (CR) between the tau(x) - tau(y) spin levels of one triplet coumarin molecule and the tau(y) - tau(z) spin levels of another triplet coumarin. Rate equations that describe the time behavior of the populations of the spin levels which are involved in the CR process are described and numerically solved. CR behavior is found to be strongly dependent on the total coumarin triplet concentration. GRA

N79-29985# California Univ., Los Angeles. Dept. of Chemistry.

METALLOCARBORANES IN CATALYSIS 4. THE MOLECULAR STRUCTURE OF 3-PPh3-3-CO-4-C5H5N-3,1,2-RhC2B9H10 Interim Report

Raymond G. Teller, Joseph J. Wilczynksi, and M. Frederick Hawthorne 30 Apr. 1979 12 p refs
(Contract N00014-76-C-0390; Grant NSF CHE-76-05926)
(AD-A068697; TR-104) Avail: NTIS HC A02/MF A01 CSCL 07/2

The utility of rhodium carborane complexes as catalysts for industrially important processes has been demonstrated. As part of our research effort in this area 1-5 we recently prepared 3,3-(PPh3)2-4-C5H5N-3,1,2-RhC2B9H10(I) and its carbonyl derivative 3-PPh3-3-CO-4-C5H5N-3,1,2-RhC2B9H10(II) in order to ascertain their catalytic act. GRA

N79-29986# Pittsburgh Univ., Pa. Dept. of Physics and Astronomy.

DEVELOPMENT AND TESTING OF A THREE-STAGE DOUBLE TANDEM ACCELERATOR-DECELERATOR SYSTEM FOR LOW ENERGY, HIGHLY STRIPPED IONS Progress Report, 1 Mar. 1978 - 28 Feb. 1979

James E. Bayfield Nov. 1978 27 p refs
(Contract EG-77-S-02-4257)
(COO-4257-2) Avail: NTIS HC A03/MF A01

Three-stage operation of the acceldecel double tandem source of highly stripped ion beams is described. The system produced O(5+), O(6+), O(7+), and O(8+) ions at specific energies as low as 15 keV per a mu. The design of the decelerator tubes is discussed. The performance and limitations of the overall system are outlined. Some charge exchange cross sections were measured, for combined higher ion charge states and lower ion energies than hertofore was possible. DOE

N79-29987# Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany).

MEASUREMENT OF RATE CONSTANTS ASSOCIATED WITH COLLISION INDUCED TRANSITIONS BETWEEN SPECIFIC ROTATION ENERGY LEVELS OF Li2 (ASIGMAu+) AND Li2 (XSIGMAg+) USING LASER SPECTROSCOPY Thesis - Goettingen Univ. West Ger. [MESSUNG DER GESCHWINDIGKEITSKONSTANTEN FUER STOSSINDUZIERTE UEBERGAENGE ZWISCHEN SPEZIFISCHEN ROTATIONSNIVEAUS VON Li2 (ASIGMA u+) bzw. Li2(XSIGMAg+) MITTELS LASERSPEKTROSKOPIE]

Manfred Schroeder Jul. 1978 139 p refs In GERMAN
(MPIS-9/1978) Avail: NTIS HC A07/MF A01; Goettingen, West Ger. DM 22.95

Rotational excitations of Li2 (A1Sigma u+) generated by collisions with rare gas atoms were studied using laser induced fluorescence. The variable tuning dye laser employed enabled the J dependence of the associated cross sections to be investigated. Some characteristics of these cross sections (in particular, asymmetry) were studied theoretically (classical model, semiclassical perturbation theory). Agreement with measured values is satisfactory. Rotation transitions of Li2(X1Sigma g+) from J+ or -6 were determined from a double resonance experiment and laser induced fluorescence. Total rotation-vibration cross section for excited A and B states are 2 and 4 times too small respectively. Temperature determination errors acount for large discrepancies in the measurement of absolute cross sections. Author (ESA)

N79-29988# National Standard Reference Data System.

RATE COEFFICIENTS FOR ION-MOLECULE REACTIONS. ORGANIC IONS OTHER THAN THOSE CONTAINING ONLY C AND H

L. Wayne Sieck Feb. 1979 31 p refs Sponsored by National Measurement Lab., NBS
(PB-294304/1; NSRDS-NBS-64; LC-78-10710) Avail: NTIS HC A03/MF A01 CSCL 07D

A compilation is presented of all experimentally determined

bimolecular and termolecular rate coefficients for the reactions of organic ions (other than those containing only C and H) with neutral molecules in the vapor phase. The literature covered is from 1960 to the present, and both positive and negative ions are considered. Five hundred and seventy-seven separate reaction partners are tabulated, and experimental conditions are specified wherever possible. Preferred values are suggested for a number of these processes. GRA

73 NUCLEAR AND HIGH-ENERGY PHYSICS

Includes elementary and nuclear particles; and reactor theory.

For space radiation see *93 Space Radiation*.

N79-29989 California Univ., Riverside.
PION PRODUCTION IN HIGH ENERGY HEAVY ION COLLISIONS Ph.D. Thesis
Jia-Jih Lu 1979 219 p
Avail: Univ. Microfilms Order No. 7918254

Exploratory studies on pion production in relativistic heavy ion collisions were carried out utilizing a triggered streamer chamber. Three topics of pion production were investigated: (1) pion production mechanism, (2) pion interferometry, and (3) heavy ion central collisions. In the study of pion production mechanism, detail comparisons of experimental data with various theoretical models were made. An overall picture of pion production in relativistic heavy ion collisions was obtained. Pion correlation through the technique of pion interferometry was investigated. The first evidence of pion interferometric correlation effect in nuclear reactions was observed. The space-time structure of pion-emitting source from the interference was inferred. An exploratory study of heavy ion central collisions was performed. Interesting features from the data are discussed.
Dissert. Abstr.

N79-29990 Virginia Univ., Charlottesville.
NUCLEAR FRAGMENT PRODUCTION FROM 720-MeV ALPHA-INDUCED REACTIONS Ph.D. Thesis
Thomas Charles Schweizer 1979 64 p
Avail: Univ. Microfilms Order No. 7916256

Heavy-fragment ($Z > 2$) energy spectra from 720 MeV alpha-induced nuclear reactions on Al, Ag and Ta have been measured at 30 deg, 60 deg, 90 deg and 120 deg. The angular distributions are not well reproduced by thermodynamic evaporation models with either one or two emitting sources. The anisotropy of the low-Z fragments is, however, better described by three sources whose evenly spaced velocities and temperatures indicate that the three sources may represent a discrete approximation to an actual continuum of sources. The observed anisotropy may also be a manifestation of large contributions to the forward-angle cross sections from pre-equilibrium fragment emission. Extension of this analysis to our hydrogen-and helium-isotope data indicates that the light fragments continue the trends exhibited by the heavy-fragment data. A comparison with data from proton-induced reactions indicates that the anisotropy observed may be a manifestation of higher energy and momentum deposition in the target nucleus by alpha-particles than by protons. Dissert. Abstr.

N79-29991 Maryland Univ., College Park.
A CALCULATION OF CHARGE DEPENDENCE AND CHARGE ASYMMETRY IN THE NUCLEON-NUCLEON INTERACTION DUE TO PROCESSES INVOLVING DELTAS Ph.D. Thesis
Thomas Beckwith Wells 1978 124 p
Avail: Univ. Microfilms Order No. 7917133

The charge dependence and charge asymmetry of the nucleon-nucleon force arising from the exchange of a pion and a photon with the excitation of a nucleon resonance is calculated. This charge dependence and asymmetry is studied through its effects on the 1S nucleon-nucleon scattering lengths. The calculation is performed first using a pole approximation for the resonance and a second time with a Chew-Low description of the resonance. Both calculations neglect nuclear recoil. Estimates of this effect are made. The changes in the scattering lengths are small (less than 0.3 fm) in both cases. Dissert. Abstr.

N79-29992 Stanford Univ., Calif.
MAGNETIC MOMENTS OF SHORT-LIVED NUCLEAR STATES: MEASUREMENTS AND STUDY OF THE RECOIL-INTO-GAS METHOD Ph.D. Thesis
Stephen Mark Lazarus 1979 208 p
Avail: Univ. Microfilms Order No. 7917249

Magnetic hyperfine interactions of short lived nuclear states were studied using the recoil-into-gas technique. The g-factors of the first 2(+) excited states of Pd-104,-106,-110 and Cd-110,-112,-114 were measured and a study of methods performed. A Cl beam of incident energy 64.5 MeV was used to Coulomb excite the target nucleus. Measurements were performed using the two-detector ratio method to observe the angular distribution. A study was made to determine if the Doppler broadened gamma ray lineshape observed at 90 degrees could be used to provide a single detector method of observing the changes in the angular distribution. The resulting g-factors are presented. The Doppler broadened lineshapes failed to provide a reliable means of extracting the g-factors.
Dissert. Abstr.

N79-29993 State Univ. of New York at Stony Brook.
A SURVEY OF RADIATIVE DIPOLE STRENGTH FUNCTIONS Ph.D. Thesis
Carol Martha McCullagh 1979 233 p
Avail: Univ. Microfilms Order No. 7918047

Neutron capture gamma-ray spectroscopy was used to investigate the systematic behavior of radiative transitions from the capture state. Thirteen measurements using the (N, gamma) reaction following thermal, resonance-averaged and discrete-resonance capture were performed. The thermal and resonance-averaged results provided many of the final state spins and parities needed to determine the multipolarity of the radiative transitions. Absolute partial radiative widths were obtained from the discrete-resonance measurements using one of the three following ways: (1) absolutely; (2) relative to the well-know partial widths of the 4.9 eV Au-198 resonance or (3) relative to Au-198 at thermal energies. The results of the work were combined with all known previous measurements to form a comprehensive survey of electric and magnetic dipole absolute partial widths in approximately fifty nuclides. Dissert. Abstr.

N79-29994 Pittsburgh Univ., Pa.
HADRONIC ATOMS IN MOMENTUM SPACE Ph.D. Thesis
Yong Rae Kwon 1978 96 p
Avail: Univ. Microfilms Order No. 7917481

A momentum space method for hadronic atoms was developed which incorporates relativistic, nonlocal, and absorptive hadron-nucleus interactions. The logarithmic singularity due to the Coulomb interaction was treated by Lande's subtraction technique. Vacuum polarization, and both nuclear and pion finite-size effects were included. Precision eigenvalues and eigenfunctions for the Schroedinger, relativistic Schroedinger, Klein-Gordon (of various types), and Dirac equations were calculated using a rapid and convenient inverse iteration method. Reliability of the approach was confirmed by comparing with parallel coordinate space methods. Several illustrative applications are made to simple pionic cases to demonstrate possible applications. A nonstatic model for kaonic atoms is presented. The R-N t matrix is developed which can be used for constructing a kaon-nucleus optical potential. Dissert. Abstr.

N79-29995 New Mexico State Univ., University Park.
TWO RELATIVISTIC QUARK MODELS WITH A HARMONIC OSCILLATOR POTENTIAL Ph.D. Thesis
Ramadan Yahia Halasa 1979 72 p
Avail: Univ. Microfilms Order No. 7918224

In a model based on the Klein-Gordon equation, the quark-antiquark interaction is considered to be a harmonic oscillator potential which behaves as the fourth component of a four-vector. The bound-state meson mass spectra are calculated using the WKB approximation method. The resulting mass spectra are not significantly different from those obtained by Kang and Schnitzer using a linear potential. In the second model which is

based on the Dirac equation, the harmonic oscillator potential is used as a scalar. This is equivalent to generalizing the mass as m(r) = mu + (a cubed)(r squared). The energy values turn out to be complex and become almost real for values of mu/a > or equal about 2. Dissert. Abstr.

N79-29996 Princeton Univ., N. J.
HIGHER ORDER EFFECTS IN SEMI-CLASSICAL QUANTUM CHROMODYNAMICS Ph.D. Thesis
Herbert Levine 1979 131 p
Avail: Univ. Microfilms Order No. 7918561

The general question of how to evaluate corrections to the lowest order multi-instanton approximation to QCD is investigated. A complete formalism is developed to deal with this question and is applied to higher order effects in several semiclassical calculations. These include the force between instantons, the heavy quark potential, and the density of instantons. The results lend support to the validity of many of the qualitative predictions about the structure of QCD which emerged from the lowest order semiclassical analysis. At the same time, it is shown that many of the more naive attempts at making instanton effects calculable and experimentally accessible are inconsistent when higher order contributions are taken into account. Finally, a few remarks are offered regarding the outlook for the entire semiclassical QCD program as it is now understood.
Dissert. Abstr.

N79-29997 Pittsburgh Univ., Pa.
RADIATION EFFECTS IN TITANIUM-SILICATE SYSTEMS Ph.D. Thesis
Laila Nabih Makar 1978 154 p
Avail: Univ. Microfilms Order No. 7917433

A spectrophotometric analysis is presented of the changes in the absorption bands that are related to titanium in glasses and crystalline silicates after exposure to ionizing radiation.
Dissert. Abstr.

N79-29998 College of William and Mary, Williamsburg, Va.
GAMMA-RAY RADIATION STUDIES OF UNDOPED GaAs Ph.D. Thesis
William Paul Winfree 1978 84 p
Avail: Univ. Microfilms Order No. 7918474

High purity GaAs crystals were irradiated at room temperature with gamma rays. Pulsed NMR was then used to measure the effect of any stable defects introduced into the samples. No increases in the number of stable defects were found as a consequence of irradiating these samples. The carrier concentrations of the samples also did not change appreciably. This was determined by examining the temperature dependence of the NMR decay shape and by an independent measurement of the carrier concentration. A model to explain the absence of new stable defects is suggested. The degree of homogeneity of GaAs samples held at temperatures, from 550 C to 700 C, in an evacuated chamber for twenty-four hours and then quench cooled to room temperature was used to estimate a lower limit of the pure GaAs self diffusion constant for the temperatures at which it was thermally damaged. The lower limit found is much greater than the value quoted in the literature. Dissert. Abstr.

N79-29999# Nagoya Univ. (Japan). Inst. of Plasma Physics.
A GENERALIZATION OF INVERSE SCATTERING METHOD
M. Wadati, K. Konno, and Y. H. Ichikawa Mar. 1979 8 p refs
(IPPJ-381) Avail: NTIS HC A02/MF A01

A scheme of the inverse scattering method is presented by examining a generalized eigenvalue problem of Ablowitz-Kaup-Newell-Segur scheme. As an illustration of the scheme, explicit expressions of the eigenvalue problem and the temporal evolution equation of the eigenfunction are presented for a generalized nonlinear Schroedinger equation, of which nonlinear terms are composed of the usual cubic nonlinear term and the derivative cubic nonlinear term. K.L.

N79-30000# Oak Ridge National Lab., Tenn.
CYCLOTRONS: 1978
J. A. Martin, comp. 1978 210 p refs Presented at Conf. on Cyclotrons and Their Applications, Bloomington, Ind., 18 Sep. 1978 Submitted for publication
(Contract W-7405-eng-26)
(CONF-780957-8) Avail: NTIS HC A10/MF A01

A compilation is presented of the experimental facilities of the world's cyclotrons including history and status, staff and operation, research staff, target facilities, magnet, acceleration system, vacuum system, characteristic beams, beam properties, and a plan view of the facility for each cyclotron. DOE

N79-30001# Oak Ridge National Lab., Tenn.
PROCEDURES MANUAL FOR THE OAK RIDGE ELECTRON LINEAR ACCELERATOR
H. A. Todd 8 Feb. 1979 51 p
(Contract W-7405-eng-26)
(ORNL/TM-6801) Avail: NTIS HC A04/MF A01

Specific information pertaining to the operation and safety of the facility is presented. Items such as the interlock system, radiation monitoring, emergency procedures, night shift and weekend operation, and maintenance are discussed. DOE

N79-30002# Los Alamos Scientific Lab., N. Mex.
PROPOSAL FOR THE STUDY OF LAMINAR RELATIVISTIC ELECTRON BEAM GENERATION FOILLESS DIODE
L. E. Jones and L. E. Thode Feb. 1979 18 p refs
(Contract W-7405-eng-36)
(LA-7681-P) Avail: NTIS HC A02/MF A01

A continued investigation of foilless diode generaties of a 5 to 50 MeV electron beam is proposed. The objective is to determine the feasibility of obtaining a beam with a local energy density of 10 to the 19th power to 10 to the 22d power eV/cer cm, With sufficient microscopic quality to be applicable to high-density plasma heating, submillimeter microwave generation, and collective ion acceleration. DOE

N79-30003# Illinois Univ., Urbana. Dept. of Physics.
HIGH-ENERGY PHOTOPRODUCTION OF THE RHO AND RHO' VECTOR MESONS Ph.D. Thesis
John Michael Bronstein 1977 135 p refs
(Contract EY-76-C-02-1195)
(COO-1195-412) Avail: NTIS HC A07/MF A01

In an experiment in the broad band photon beam at Fermilab, diffractive production of 2 pi(+-) and states from Be,Al,Cu, and Pb targets was observed. The 2 pi data is dominated by the rho(770) and the 4 pi (+-) is dominated by the rho'(1500). The energy dependence of rho photoproduction from Be was measured, and no evidence seen for energy variation of the forward cross section in with its average value d signs/dt/sup 0=3.42 +-0.28 micron b/Ge sq V over the entire range. For the rho' a mass of 1487 +-20 MeV and a width of 675 +-60MeV were obtained. All quoted errors are statistical. Results for the photon coupling constants are in good agreement with GVMD and the storage the e(+)e(-) storage ring results. The approximate equality of the rho-nucleon and rho'-nucleon total sections is inconsistent with the diagonal version of GVMD and provides strong motivation for including transitions between different vector mesons in GVMD. DOE

N79-30004# Battelle Pacific Northwest Labs., Richland, Wash.
WASTE ISOLATION SAFETY ASSESSMENT PROGRAM SCENARIO ANALYSIS METHODS FOR USE IN ASSESSING THE SAFETY OF THE GEOLOGIC ISOLATION OF NUCLEAR WASTE
J. Greenborg, W. K. Winegardner, P. J. Pelto, J. W. Voss, J. A. Stottlemyre, I. A. Forbes, J. B. Fussell, and H. C. Burkholder Nov. 1978 49 p
(Contract EY-76-C-06-1830)
(PNL-2643) Avail: NTIS HC A03/MF A01

The relative utility of the various safety analysis methods to scenario analysis for a repository system was evaluated by judging the degree to which certain criteria are satisfied by use of the method. Six safety analysis methods were reviewed for possible use in scenario analysis of nuclear waste repositories: expert opinion, perspectives analysis, fault trees/event trees, Monte Carlo simulation, Markov chains, and classical analysis. Expert opinion, fault trees/event trees, Monte Carlo simulation, and classical systems analysis were judged to have the greatest potential application to the problem of scenario analysis. To get the best understanding of system behavior, a combination of the methods is recommended. Monte Carlo simulation was judged

to be the most suitable matrix in which to incorporate a combination of methods. DOE

N79-30005# Oak Ridge National Lab., Tenn.
SOURCES, AMOUNTS, AND CHARACTERISTICS OF LOW-LEVEL RADIOACTIVE SOLID WASTES
A. H. Kibbey and H. W. Godbee 1979 6 p refs Presented at the 12th Health Phys. Soc. Midyear Topical Symp., Williamsburg, Va., 12 Feb. 1979
(Contract W-7405-eng-26)
(CONF-790209-6) Avail: NTIS HC A02/MF A01

An estimation of the accumulation of low-level radioactive solid wastes that are generated in the nuclear fuel cycle, national defense programs, institutional (especially medical/biological) applications, and other research and development activities is reported. DOE

N79-30006# Central Electricity Generating Board, Gloucester (England). Generation Development and Construction Div.
A METHOD FOR DECONTAMINATING THE COOLANT CIRCUIT OF WATER-COOLED NUCLEAR REACTORS
J. E. Newell, inventor Dec. 1978 9 p
(TDB-300) Avail: NTIS HC A02/MF A01

The proposed decontamination method involves circulating through the coolant circuit, under a pressure of at least 5 bar, a solution of carbon dioxide and carbonic acid in water with a pH of between 3.0 and 5, and either recirculating the carbonic acid solution through a cation exchange resin to remove iron, or depressurizing the solution into a holding tank and passing an oxygen-containing gas through the depressurized solution to precipitate dissolved iron oxide as ferric hydrocide. Author (ESA)

74 OPTICS

Includes light phenomena.

N79-30007 Illinois Univ. at Urbana-Champaign.
GROWTH AND CHARACTERIZATION OF In(1-x)Ga(x)As(y)P (1-y) FOR NEAR INFRARED PHOTODETECTORS Ph.D. Thesis
Milton Feng 1979 134 p
Avail: Univ. Microfilms Order No. 7915346

Methods for the growth of InGaAsP on an Inp substrate by liquid phase expitaxy (LPE) are discussed. The distribution coefficients for growth of lattice-matched InGaAsP, with bandgaps in the 1.15-1.31 micron m spectral range, on (100)InP substrates are given. The dependence of the surface morphology and the interface misfit dislocation density on the amount of lattice mismatch varies considerably with the composition of the quaternary material in this bandgap range. Zn-diffused, LPE grown, and Be-implanted p-n junctions in both InP and InGaAsP materials for photodetectors were examined. Currently, the best photodiodes fabricated are ion implanted and have quantum efficiencies equal to or > 65% throughout the 0.95 to 1.31 micron m wavelength range. The leakage current is less than 1 micron A at 104 V, and a low-frequency gain of 100 was measured at 116 V, for a photodiode with a breakdown voltage of 120 V.Dissert. Abstr.

N79-30008*# TAI Corp., Huntsville, Ala.
AXAF OPTICAL TECHNOLOGY ANALYSIS Final Report
Dietrich Korsch Jul. 1979 30 p
(Contract NAS8-33158)
(NASA-CR-161284) Avail: NTIS HC A02/MF A01 CSCL 20F

A grazing incidence telescope with six nested subsystems is investigated through the effects of misalignment and surface deformations on it's image quality. The axial rms-spot size serves as measure for the image quality. The surface deformations are simulated by ellipsoidal and sinusoidal deviation elements. Each type of defect is analyzed in the single two-element system. The full nested system is then analyzed in the presence of all possible defects on all twelve elements, whereby the magnitude of the defects is randomized within a given upper limit. A.W.H.

N79-30009# Canada Inst. for Scientific and Technical Information, Ottawa (Ontario).
POLARIZATION PROPERTIES OF CUBE-CORNERS: PRESENTATION OF EXPERIMENTALLY VERIFIED MATRICES
Gunter Hege and Klaus Leonhardt 1979 27 p refs Transl. into ENGLISH from Optik (West Germany), v. 47, no. 2, 1977 p 167-184
(NRC/CNR-TT-1944; ISSN-0077-5606) Avail: NTIS HC A03/MF A01

Cube-corners (also called corner reflectors and pyramidal reflectors) are widely used as retroreflectors. They also offer interesting possibilities as end reflectors in two-beam interferometers and as elements of optical resonators. In all applications involving interference phenomena, however, consideration must be given to oblique incidence on reflecting surfaces of the cube-corner. In general, entering and emerging light is polarized differently. Measurements were carried out on a totally reflecting cube-corner and a silvered cube-corner (on those surfaces effective for the three internal reflections) so as to determine experimentally the element matrix, in each case, for three wavelengths. G.Y.

N79-30010*# Battelle Memorial Inst., Columbus, Ohio.
AN INVESTIGATION FOR THE DEVELOPMENT OF AN INTEGRATED OPTICAL DATA PREPROCESSOR Final Report, 12 Oct. 1976 - 15 Dec. 1978
C. M. Verber, D. W. Vahey, R. P. Kenan, V. E. Wood, N. F. Hartman, and C. M. Chapman Jun. 1978 152 p refs
(Contract NAS1-14655)
(NASA-CR-3151) Avail: NTIS HC A08/MF A01 CSCL 20F

The successful fabrication and demonstration of an integrated optical circuit designed to perform a parallel processing operation by utilizing holographic subtraction to simultaneously compare N analog signal voltages with N predetermined reference voltages is summarized. The device alleviates transmission, storage and processing loads of satellite data systems by performing, at the sensor site, some preprocessing of data taken by remote sensors. Major accomplishments in the fabrication of integrated optics components include: (1) fabrication of the first LiNbO3 waveguide geodesic lens; (2) development of techniques for polishing TIR mirrors on LiNbO3 waveguides; (3) fabrication of high efficiency metal-over-photoresist gratings for waveguide beam splitters; (4) demonstration of high S/N holographic subtraction using waveguide holograms; and (5) development of alignment techniques for fabrication of integrated optics circuits. Important developments made in integrated optics are the discovery and suggested use of holographic self-subtraction in LiNbO3, development of a mathematical description of the operating modes of the preprocessor, and the development of theories for diffraction efficiency and beam quality of two dimensional beam defined gratings. K.L.

N79-30011# Naval Research Lab., Washington, D. C. Optical Sciences Div.
APPLICATION OF ADVANCED OPTICAL SPECTROSCOPIES TO THE STUDY OF ENERGETIC MATERIALS Summary Report, 1 Oct. 1977 - 30 Sep. 1978
J. M. Schnur Apr. 1979 72 p refs
(Contract N00014-77-WR-80094; NR Proj. 122-402)
(AD-A068224; NRL-MR-3974) Avail: NTIS HC A04/MF A01 CSCL 20/6

This report contains a detailed description of the research performed during the past year under Contract N0014-77-WR-80094 Project Number 122-402. This series of papers reflect the progress accomplished. This research program has been investigating the applicability of advanced optical techniques to the study of complex material problems associated with high energy substances. GRA

N79-30012# Rank Optics, Leeds (England).
DESIGN STUDY FOR A FIBER OPTICS BRANCHING COUPLER Final Report
P. S. Cain, N. G. Robertson, and J. M. Russell Paris ESA Jan. 1978 114 p refs
(Contract ESTEC-2923/76-NL-AK(SC))
(ESA-CR(P)-1156) Avail: NTIS HC A06/MF A01

Various approaches to the design of a single fiber T-coupler and a multiline branching coupler were examined in order to select the most promising techniques. The definition of coupler characteristics was improved and an assessment of operational

features and performance was made. T-coupler and star coupler prototype models were built and tested. Results are analyzed in detail. Author (ESA)

N79-30013# Ecole Nationale Superieure des Telecommunications, Paris (France). Dept. Electronique et Physique.
AN INFRARED SOURCE CLASSIFICATION SYSTEM
Louis-Francois Pau 1978 17 p refs
(ENST-C-78023) Avail: NTIS HC A02/MF A01

A passive system for the classification of isolated infrared signatures is described. The hardware consists of magnifying optics, infrared filters, and beam splitters. The detector is a specially designed array consisting of two crosses 45 deg apart with 16 pyroelectric detectors on each of the 8 radial directions. The classification hardware consists of an analog parallel read-out and amplification device followed by a special purpose digital processor. The feature parameters by which the IR signature is classified into 6 alternative classes are distributions of the detector outputs along each of the 8 radial directions, isoradiation contours of the apparent picture of the source, and global IR emission at two wavelengths. Experimental as well as simulation results are presented. Author (ESA)

75 PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion.

For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

N79-30014 British Library Lending Div., Boston Spa (England).
GYROTRON UTILIZING A RELATIVISTIC ULTRA HIGH VACUUM ELECTRON BEAM FILLED WITH PLASMA
V. I. Krementsov, M. I. Petelin, M. S. Rabinovich, A. A. Rukhadze, P. S. Strelkov, and A. G. Shkvarunets Mar. 1979 10 p refs Transl. into ENGLISH from Zh. Eksp. Teor. Fiz. (USSR), v. 75, no. 6, 1978 p 2151-2154
(BLL-CTO-1616-(9091.9F)) Avail: British Library Lending Div., Boston Spa, Engl.

A gyrotron which utilizes a relativistic ultra high vacuum electron beam with an electron energy of 320 eV, a current of 1.2 kA and a pulse duration of 30 ns, was studied. A previously produced plasma was used to compensate the space charge in the beam. Microwave oscillation was obtained in the expected TE sub 12 mode, with lambda = 3 plus or minus 0.1 cm, an output power of 60 MW and a conversion efficiency of electron-beam energy into radiation of approximately 15%. The dependence of the output power on the plasma density was investigated. Author

N79-30015 British Library Lending Div., Boston Spa (England).
PRESENT STATE OF STELLARATOR RESEARCH
M. S. Rabinovich Mar. 1979 49 p refs Transl. into ENGLISH of Preprint from Lebedev Inst. of Phys., Acad. of Sci. USSR, Moscow, 1979
(BLL-CTO-1608-(9091.9F)) Copyright. Avail: British Library Lending Div., Boston Spa, Engl.

The general principles of toroidal systems with helical symmetry which enable plasmas to be contained in the currentless regime are used in a comparison of three stellarators, roughly similar in dimension, but with different magnetic field configurations. These are CLEO, L-2, and W VIIA. The current carrying regime of each is described. Topics covered include MHD activity in stellarators, ion thermal conductivity, and using a stellarator as the basis for a thermonuclear reactor. Tabular and graphic material are included. A.R.H.

N79-30016 British Library Lending Div., Boston Spa (England).
ABSORPTION OF TURBULENT LASER PLASMA RADIATION
V. P. Silin Dec. 1978 19 p refs Transl. into ENGLISH from conference paper, 12th European Conf. on Laser Interaction with Matter (Moscow), Dec. 1978 19 p Presented at the 12th European Conf. on Laser Interaction with Matter, Moscow, Dec. 1978
(BLL-CTO-1584-(9091.9F)) Avail: British Library Lending Div., Boston Spa, Engl.

The development of a theory of parametric instabilities in an inhomogeneous laser plasma shows that the size of the spatial region in which the turbulent state develops is comparable with the characteristic dimension of a several-fold fluctuation in the plasma density close to its critical value. The conditions are identified under which parametric turbulence gives an anomalous effective collision frequency substantially greater than the normal electron-ion collision frequency. Conditions are found for the development of anomalous dissipation which results in heating of the bulk of the electrons. Under opposite conditions, the dynamic behavior shows that under slow plasma conditions, a considerable proportion of the laser energy absorbed by the plasma is transferred to the fast electrons. Suppression of the Cerenkov mechanism is observed on transition to fast plasma flow conditions. G.Y.

N79-30017 British Library Lending Div., Boston Spa (England).
SYNCHRONISATION OF ELECTRON-BEAM CONTROLLED CO2 LASERS WITH A PLASMA MIRROR
N. G. Basov, V. A. Boiko, V. A. Danilychev, V. D. Zvorykin, A. N. Lobanov, I. V. Kholin, and A. Yu. Chugunov Mar. 1979 7 p refs Transl. into ENGLISH from Kvantovaya Elektron. (USSR), v. 5, no. 12, 1978 p 2635-2637
(BLL-CTO-1595-(9091.9F)) Avail: British Library Lending Div., Boston Spa, Engl.

A paper is presented which is concerned with the time-synchronized operation of several lasers required for symmetrical irradiation. It is noted that the lasers cannot be synchronized accurately by stabilizing only the electrical parameters of the system. Even if the laser pumping systems are switched on strictly simultaneously, small random fluctuations in the pumping level, active mixture composition, optical Q factor of the resonators and other parameters give rise to an appreciable scatter in the output pulse evolution times. Methods for precise synchronization based on introducing optical coupling between the laser resonators are proposed. G.Y.

N79-30018 British Library Lending Div., Boston Spa (England).
RADIATION SHIELDING NEAR A CONTROLLED FUSION RESEARCH FACILITY: THE FONTENAYAUX-ROSES TOKAMAK TFR
Feb. 1979 32 p refs Transl. into ENGLISH from Radioprotection (France), v. 12, no. 3, 1977 p 217-241
(BLL-CTO-1586-(9091.9F)) Avail: British Library Lending Div., Boston Spa, Engl.

The results of X-ray and neutron dosimetry measurements near the magnetic confinement device for hot plasmas known as TFR are presented. The biological shielding consists of an ordinary concrete wall 30 cm thick; the dose rate is thus limited to 0.1 mrem per discharge or approximately 10 mrem per day throughtout the area frequenced by people during operation of the TFR. Numerical calculations allowing for the true geometry and X-ray reflection from the walls and roof, and normalized to the measurements, give the characteristics of the electron beam which is the source of this radiation. Photoneutron generation (up to 10 to the 10th power neutrons per discharge) and activation of the vacuum vessel are casued by high energy electrons > or = 10 MeV) carrying a current of 10-1000 A. K.L.

N79-30019 British Library Lending Div., Boston Spa (England).
ESTIMATE OF THE CRITICAL PLASMA EQUILIBRIUM PRESSURE IN A HIGH-SHEAR STELLARATOR
I. S. Danilkin Feb. 1979 19 p refs Transl. into ENGLISH from Fiz. Plazmy (USSR), v. 4, no. 5, Sep. - Oct. 1978 p 1033-1043
(BLL-CTO-1583-(9091.9F)) Avail: British Library Lending Div., Boston Spa, Engl.

One of the important parameters indicating the potential usefulness of a toroidal system as a possible prototype for a fusion reactor is the attainable value of beta = 8 pi p/sq B which is the ratio of the critical plasma gas kinetic pressure to the pressure of the confining magnetic field sq B/8 pi. The characteristic features associated with estimating the attainable value of beta are analyzed for a stellarator similar to the Liven'-2 stellarator which has a quadrupole helical field. A.R.H.

N79-30020 Virginia Univ., Charlottesville.
THE GLOW DISCHARGE AS AN ANALYTICAL ATOMIZA-

TION AND IONIZATION SOURCE Ph.D. Thesis
Carlos Gustavo Bruhn 1979 343 p
Avail: Univ. Microfilms Order No. 7916232

An atomization source was constructed and applied to the analysis of trace elements in solution residues by atomic absorption spectroscopy. Copper and graphite, investigated as cathode materials, showed differences in their sputter characteristics. The cathode surface microstructure was examined with a scanning electron microscope and the effects of fill gas, net sputter time, discharge current and gas pressure were studied. The analysis of Cs, Mg, Zn, Au, Ni and Sn in solution residues showed detection limits ranging to a few nanograms with precisions of 3-8%. A second source with a hollow cathode was designed and coupled to a quadrupole mass filter, forming a simple mass spectrometric system for trace element analysis of solids and solution residues. The discharge showed good stability, which was reflected in significantly better reproducibility and precision as compared to the conventional spark source mass spectrometric technique.
Dissert. Abstr.

N79-30021 Florida State Univ., Tallahassee.
THE OPTIMIZATION AND APPLICATION OF REDUCED-PRESSURE MICROWAVE PLASMAS FOR GAS PHASE ANALYSIS Ph.D. Thesis
Dianna Gail Jones 1978 196 p
Avail: Univ. Microfilms Order No. 7917048

Reduced-pressure microwave-induced helium and argon plasmas were studied to determine their analytical utility as detectors which would not require prior separation procedures for gas phase samples. The plasma was sustained over a pressure range of 1 to 25 torr by a 2450 MHz, 100 W, microwave generator. Optimization studies of tuning screw setting, pressure gas flow, applied microwave power and temperature of the entering gas indicated that microwave energy was coupled more efficiently to the helium plasma. An investigation on the effect of the sublimation of P4O10 into the plasma was conducted. The optimized helium plasma was used to detect chlorine emission in CCl4 and CH2Cl2 and phosphorus emission in malathion. Possible future applications of the microwave induced plasma detector system are suggested. Dissert. Abstr.

N79-30022 Stanford Univ., Calif.
THREE DIMENSIONAL ELECTROMAGNETIC PARTICLE SIMULATION OF FUSION PLASMAS Ph.D. Thesis
Dale Edwin Nielsen, Jr. 1979 215 p
Avail: Univ. Microfilms Order No. 7917265

The case of neutral beam injection into a plasma which was confined by a typical mirror magnetic field was studied. Neutral injection for mirror plasmas was developed in order to stimulate the buildup of diamagnetic currents in the plasma. The self-fields from these currents cause the total magnetic field to become reversed, a field topology which dramatically enhances plasma confinement. Simulation results from SPLASH (the simulation code) show that intensely pulsed neutral injection can lead to radial charge separation, which drives a variety of instabilities. Both physical and numerical aspects of the simulation are discussed. Dissert. Abstr.

N79-30023# Nagoya Univ. (Japan). Inst. of Plasma Physics.
EXPERIMENTAL STUDIES OF A SHOCK-HEATED DENSE PLASMA
Seishiro Hashiguchi and Masaaki Inutake Mar. 1979 29 p refs
(IPPJ-376) Avail: NTIS HC A03/MF A01

High-pressure dense plasmas were produced behind the reflected shock wave in argon, krypton, or xenon gas in an arc driven shock tube. The pressure, the absolute intensity of continuum radiation, and the transmittance of the plasma at 633nm were measured. The temperature is determined from the absolute intensity and the transmittance. The pressure ranges from 10 to 300-atmospheres, while the temperature is around 1eV. The temperature is also obtained from the experimental values of pressure and the transmittance without the value of the absolute intensity using the theoretical value of the absorption coefficient of the plasma. The electron density of the plasma is calculated from the experimental value of pressure and temperature using the Debye-Huckel plasma model; it ranges from 10 to the 18th power/cc to 10 to the 19th power/cc behind the reflected shock. The plasma parameter of these plasmas ranges mainly from 2 to 7. A.R.H.

N79-30024# Nagoya Univ. (Japan). Inst. of Plasma Physics.
EIGENVALUE PROBLEM AND NONLINEAR EVOLUTION OF KINK MODES IN A TOROIDAL PLASMA
T. Ogino, S. Takeda, H. Sanuki, and T. Kamimura Apr. 1979 55 p refs
(IPPJ-382) Avail: NTIS HC A04/MF A01

The internal kink modes of a cylindrical plasma are investigated by a linear eigenvalue problem and their nonlinear evolution is studied by three dimensional MHD simulation based on the rectangular column model under the fixed boundary condition. The growth rates in two cases, namely uniform and diffused current profiles are analyzed in detail. The time evolution of the $m=1$ mode showed that $q>1$ is satisfied at the relaxation time (q safety factor), a stable configuration like a horse shoe (a new equilibrium) was formed. Also, the time evolution of the pressure p for the $m=2$ mode showed that a stable configuration like a pair of anchors was formed. A.W.H.

N79-30025# Nagoya Univ. (Japan). Inst. of Plasma Physics.
NONLINEAR EVOLUTION OF THE RESISTIVE MHD MODES AND SAWTOOTH OSCILLATION IN A TOROIDAL PLASMA
T. Ogino, S. Takeda, J. Sanuki, and T. Kamimura Apr. 1979 47 p refs
(IPPJ-383) Avail: NTIS HC A03/MF A01

The nonlinear stabilities of resistive MHD modes are investigated by a three dimensional simulation based on a rectangular column model under the fixed boundary condition. These modes for a Tokamak configuration with safety factor at the center wall approximately >3 and a safety factor at the center approximately <2 are examined. To explain the saw-tooth oscillation, the nonlinear evolution of resistive MHD modes is studied which, through magnetic island formation, leads either to a saturation of these modes (a new nonaxisymmetric equilibrium) or to a redistribution of the flux and field line reconnection in Kadomtsev's sense (a new axisymmetric equilibrium). Resistive modes with low poloidal mode number ($m=2,3,\ldots$) are considered to interpret some internal disruptions observed in Tokamaks. A.R.H.

N79-30026# Nagoya Univ. (Japan). Inst. of Plasma Physics.
EQUILIBRIA OF THE HIGH-BETA TOKAMAK AND NONLINEAR EVOLUTION OF THE m=1 KINK BALLOONING MODE
T. Ogino, S. Takeda, H. Sanuki, and T. Kamimura Apr. 1979 30 p refs
(IPPJ-384) Avail: NTIS HC A03/MF A01

The nature of nonlinear evolution of ballooning mode for not so large value of the aspect ratio, $R/a=2$ similar to 3, the parameter dependence on the critical Beta, and the stable high-Beta equilibrium configuration were investigated by a three dimensional MHD simulation based on a rectangular torus model. Consequently, a stable equilibrium is found with up 5% average Beta value by adjusting the vertical magnetic field and the diamagnetic effect. It turns out that ballooning modes form large convective cells concentrated in regions of unfavorable magnetic field line curvature. The difference between the $m=1$ internal kink mode and the ballooning mode is also discussed. Author

N79-30027# Nagoya Univ. (Japan). Inst. of Plasma Physics.
SOLITON SOLUTIONS IN A DIATOMIC LATTICE SYSTEM
Nobuo Yajima and Junkichi Satsuma Apr. 1979 17 p refs
(IPPJ-386) Avail: NTIS HC A02/MF A01

A continuum limit is considered for a diatomic lattice system with a cubic nonlinearity. A long wave equation describing the interaction of acoustic and optical modes is obtained. It reduces, in certain approximations, to equations having coupled wave solutions. The solutions exhibit trapping of an optical mode by an acoustic soliton. The form of the trapped optical wave depends on the mass ratio of adjacent particles in the diatomic lattice.
Author

N79-30028# Naval Research Lab., Washington, D. C.
VECTOR OPERATIONS IN A DIPOLE COORDINATE SYSTEM

Joseph H. Orens, Theodore R. Young, Jr., Elaine S. Oran, and Timothy P. Coffey 7 May 1979 9 p
(RR0330242)
(AD-A068680; NRL-MR-3984) Avail: NTIS HC A02/MF A01 CSCL 12/1

For many physical systems, especially those in the earth's magnetosphere or in solar flares, the major component of the plasma motion is along the magnetic field which is approximately dipolar. For such systems, resolving the flow into dipole coordinates is often beneficial. This report presents a list of the most common mathematical formulas and operations used in the application of a dipole coordinate system. GRA

N79-30029# New Jersey Inst. of Technology, Newark.
HALL CURRENT EFFECT OF TEARING MODES IN ROTATING REVERSE FIELD PLASMAS Final Report, Oct. 1977 - Sep. 1978
J. Kappraff, William Grossman (New York Univ., N.Y.), and Michael Kress (New York Univ., N.Y.) Mar. 1979 87 p refs
(Contract N00014-78-C-0264)
(AD-A068636) Avail: NTIS HC A04/MF A01 CSCL 20/9

The effect of rigid body rotation, Hall effect, and position of the outer retaining wall on the growth rates of tearing modes has been investigated for a family of reversed field Theta pinch equilibria. Parameters sensitive to the physics of a boundary line surrounding the neutral surface of the plasma are identified and used to show how stability to tearing modes is enhanced by rotation of the plasma column in a preferred direction. Stabilization of the tearing modes is also found to be sensitive to wall position and particle density and it is found that the tearing modes may even be quenched at critical values of the angular velocity for outer wall positions sufficiently close to the plasma vacuum interface. GRA

N79-30030# Wisconsin Univ., Madison. Dept. of Electrical and Computer Engineering.
TRANSPORT IN TOROIDAL STELLARATORS AND TORSATRONS
J. L. Shohet Mar. 1979 26 p refs
(Contract ET-78-S-02-5069)
(COO-5069-7) Avail: NTIS HC A03/MF A01

The behavior of stellarator/torsatron configurations in the collisionless regime is important to their viability as a fusion reactor. Various predictions of the behavior of the diffusion coefficient in this regime are summarized and compared to expected results. DOE

N79-30031# Maryland Univ., College Park. Inst. for Physical Science and Technology.
PARTICLE BEAM PELLET FUSION Final Report, 1 Nov. 1976 - 31 Jan. 1979
D. A. Tidman 1979 15 p refs
(Contract EY-76-S-05-5000)
(DOE/DP-40031/8) Avail: NTIS HC A02/MF A01

A model was developed for the propagation of a focussed ion beam through the gas that may exist in the target chamber of a reactor. The effects of beam ion stripping, background plasma generation by the beam ions, and electron avalanching in the electric fields produced by the ion pulse are included. Charge and partial current neutralization, together with stability conditions and the effects of preionization were investigated, with most recent emphasis being on the role of filamentation instabilities. DOE

N79-30032# Department of Energy, Washington, D. C. Office of Fusion Energy.
WORKSHOP ON 2-D TRANSPORT
Feb. 1979 83 p refs Workshop held at Cornell Univ., Aug. 1978
(DOE/ET-0079) Avail: NTIS HC A05/MF A01

The status of physical models used in transport calculations and to evaluate the maturity of 2-D transport codes in predicting operating parmeters of such confinement devices as Alcator, PLT, Doublet 3, and TFTR, was assessed. The following topics were discussed: status of 1-D codes, problems where 2-D treatment is necessary or useful, status of the treatment of fundamental processes, successful models, boundary and wall effects, 3-D and velocity space effects, and numerical algorithms used in transport codes. DOE

N79-30033# Argonne National Lab., Ill.
APPLICATION OF SECONDARY ION EMISSION TO IMPURITY CONTROL IN TOKAMAKS
A. R. Krauss and D. M. Gruen 1979 7 p refs Presented at 1st Topical Meeting on Fusion Reactor Materials, Miami Beach, Fla., 29 Jan. 1979 Submitted for publication
(Contract W-31-109-eng-38)
(CONF-790125-36) Avail: NTIS HC A02/MF A01

The extent to which high Z impurities enter the plasma of a magnetic confinement fusion device depends on the kinetic energy, angle of emission, and very importantly, the charge state of the ejected material. Both the fundamental process of secondary ion emission and possible techniques for producing surfaces which give rise to high ion fraction during sputtering are studied with a view to assessing the potential of this approach to impurity control in Tokamaks. By carefully choosing materials exposed to fusion plasmas and by properly modifying the surface it may be possible to insure that nearly all the impurities are ejected as ions. As long as certain gas blanket configurations are avoided and especially if a divertor is used, it should then be possible to remove the impurities before they reach the plasma. The relative merits of a variety of materials are considered with regard to this application. DOE

N79-30034# Purdue Univ., Lafayette, Ind. Div. of Mathematical Sciences.
FIN STABILIZATION OF MAGNETICALLY CONFINED PLASMAS Final Report, 15 Sep. 1976 - 14 Dec. 1978
V. H. Weston Dec. 1978 11 p
(Contract EY-76-S-02-4125)
(COO-4125-2) Avail: NTIS HC A02/MF A01

The effect of different outer conducting configurations on the stability of a cylindrical plasma of radius a is treated with emphasis on the k approximately 0, n = 1 mode associated with the usual surface perturbation e/sup ikz + or - in theta. The stability effects of the various geometries are compared through their resulting value for the minimum vacuum energy integral. An asymptotic technique is developed for fins of infinite extent. For a/c sufficiently small, fins in the radial planes theta = 0, pi, and + or - pi/2 at a distance c from the axis, tend to have the same stabilization effect on the n = 1 mode as a concentric outer cylinder of radius B where B = square root of (2c). For more general geometry including fins of finite extent, the problem is formulated in terms of a singular differential-integral equation which is then reduced to a regular Fredholm integral equation and solved numerically. Results are given for a circular segment (-alpha < theta < alpha = A) for various values of the half-angle alpha and radius A, both in the presence of and absence of a complete circular outer conductor. DOE

N79-30035# Princeton Univ., N. J. Plasma Physics Lab.
FAST-SCANNING HETERODYNE RECEIVER FOR MEASUREMENT OF THE ELECTRON CYCLOTRON EMISSION FROM HIGH-TEMPERATURE PLASMAS
P. C. Efthimion, V. Arunasalam, R. Bitzer, L. Campbell, and J. C. Hosea Mar. 1979 15 p refs
(Contract EY-76-C-02-3073)
(PPPL-1532) Avail: NTIS HC A02/MF A01

A fast scanning heterodyne receiver was developed that measures the fundamental cyclotron emission from the PLT plasma and ascertains the time evolution of the electron temperature profile. The receiver scans 60 to 90 GHz every 10 msec and is interfaced to a computer for completely automated calibrated temperature measurements. DOE

N79-30036# Argonne National Lab., Ill.
POTASSIUM SEED ACTIVITIES IN OPEN-CYCLE MHD SYSTEM: PREDICTIONS USING A MULTIPHASE MULTICOMPONENT SOLUTION MODEL
C. C. Hsu and C. E. Johnson 1978 33 p refs Presented at the 10th Mater. Res. Symp. on Characterization of High Temp. Vapors and Gases, Gaithersburg, Md., 18-22 Sep. 1978
(Contract W-31-109-eng-38)
(CONF-780941-6) Avail: NTIS HC A03/MF A01

A multiphase, multicomponent solution model was developed

by modifying the computer program for calculation of complex chemical equilibrium compositions to include a subroutine that calculates solution formation from the condensed phase species. This model was used to predict the potassium activity in the K2O + SiO2, K2O + SiO2+Al2O3, K2O + SiO2 + MgO, and K2O + SiO2 + CaO systems over the temperature range of 2300 to 1200 K, in which condensed phase components (i.e., K2SiO3, K2Si2O5) were assumed to form an ideal solution. Calculations showed that the addition of Al2O3, CaO, or MgO to the K2O SiO2 binary system resulted in an increase in potassium activity in the gas phase, especially for CaO. Such information improves predictive capability and may be used in the selection of materials and in establishing optimum conditions for operation of the combustor-generator high temperature air heater components of an open cycle MHD system. DOE

N79-30037# Stuttgart Univ. (West Germany). Inst. fuer Plasmaforschung.

AN ANALYSIS OF OPTICAL MIXING IN PLASMA SCATTERING EXPERIMENTS

E. Holzhauer and J. H. Massig 1977 23 p refs Submitted for publication

(IPF-77-6) Avail: NTIS HC A02/MF A01

Light scattering from plasma density fluctuations using a coherent detection system is analyzed to obtain the resolution in real space and K - space. The results are applied to the case of forward scattering experiments with CO2 lasers. It is shown that a coherent scattering arrangement can essentially be described by the incident and local oscillator distribution. Author (ESA)

N79-30038# Centre de Recherches en Physique de l'Environnement Terrestre et Planetaire, Orleans (France).

ELECTRODYNAMIC MEASUREMENTS MADE WITH A PLASMA PROBE OPERATING ALTERNATIVELY IN AN ACTIVE AND PASSIVE MODE [APPAREIL DE MESURE POUR SONDES A PLASMA ELECTRODYNAMIQUES EN MODE ACTIF ET PASSIF]

R. Massif and Tan-Khue Phan Jan. 1978 184 p refs In FRENCH

(CRPE-NT-52) Avail: NTIS HC A09/MF A01

A quadrupole plasma probe for the 0.5 to 5 ev range was developed. It is intended for use in studying the role of photoelectrons in the plasma heat flux in the ionosphere and in the magnetosphere. Development of a laboratory plasma in which the magnetic field had been neutralized is discussed. The measurement method and probe design are described. The probe has an active mode, measuring the transfer independence between the two dipole loops, and a passive mode, simply receiving random signals produced by fluctuations in the natural microfield of the plasma. A comparison of the data obtained from both modes, either with a plasma in thermal equilibrium or with a nonequilibrium plasma, provides, respectively, information on the density and temperature of the electron population, or on characteristics of the minority population of suprathermal electrons. Author (ESA)

N79-30039# Fom-Instituut voor Plasmafysica, Jutphaas (Netherlands).

MAGNETIC FIELD PROFILES DURING TURBULENT HEATING IN A TOROIDAL HYDROGEN PLASMA

H. W. Kalfsbeek Dec. 1978 81 p refs Sponsored jointly by Ned. Organ. voor Zuiver-Wetenschappelijk Onderzoek (ZWO) and EURATOM

(Rept-78-114) Avail: NTIS HC A05/MF A01

The measurements of both poloidal and toroidal magnetic field components as functions of radius and time in a small turbulently headed Tokomak are described. These measurements were carried out with an array of miniature pick-up coils enclosed in a quartz tube which was inserted into the plasma. The electric fields inside the plasma as well as the parallel resistivity profiles are deduced from the measured magnetic fields. The ohmically dissipated energy is determined from the field distributions and compared with the total input energy. The experimental results are compared with the outcome of a numerical model. The consistency with information obtained from other diagnostic measurements is checked. Author (ESA)

N79-30040# Fom-Instituut voor Plasmafysica, Jutphaas (Netherlands).

NUMERICAL CALCULATIONS ON THE ANOMALOUS CURRENT PENETRATION IN A TOROIDAL HYDROGEN PLASMA

H. W. Kalfsbeek Nov. 1978 64 p refs Sponsored jointly by Ned. Organ. voor Zuiver-Wetenschappelijk Onderzoek (ZWO) and EURATOM

(Rept-78-113) Avail: NTIS HC A04/MF A01

A numerical model describing the formation and subsequent maintenance of a skin during the rise of the discharge current in the turbulent heating experiment TORTUR I is described. Computed values for the skin thickness and the plasma pressure compare satisfactorily with those obtained in the TORTUR I experiment. Author (ESA)

N79-30041# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Electron and Plasma Physics.

FORMATION OF DOUBLE LAYERS IN LABORATORY PLASMAS

Staffan Torven 1978 23 p refs Presented at 14th URSI Gen. Assembly, Helsinki, 1-9 Aug. 1978 Submitted for publication

(TRITA-EPP-78-13) Avail: NTIS HC A02/MF A01

Experimental observations of electric double layers in different types of laboratory plasmas are reviewed. Particular investigations relating to the formation of a double layer and the layer different experiments are summarized. The existence of double layers in unmagnetized as well as magnetized plasma is now well established. However, problems concerning the layer formation, the layer stability, and the origin and significance of observed high frequency fluctuations remain to be solved. Author (ESA)

N79-30042# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Electron and Plasma Physics.

ELECTRON TEMPERATURE MEASUREMENTS IN LOW DENSITY PLASMAS BY HELIUM SPECTROSCOPY. PARAMETER LIMITS FOR VALIDITY OF DIFFERENT METHODS

Nils Brenning Dec. 1978 45 p refs

(TRITA-EPP-78-16) Avail: NTIS HC A03/MF A01

Different methods to measure electron temperature in low density plasmas by He spectroscopy are examined. They are based either on the relative intensities of singlet and triplet lines or on the absolute intensities of single lines. Calculations from measured and theoretical data show that both methods are seriously influenced by secondary processes, being mainly excitation from metastable levels and excitation transfer in electron-atom collisions combined with imprisonment of resonance radiation. The calculations give parameter limits for the validity of different methods and combinations of lines. Author (ESA)

N79-30043# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Electron and Plasma Physics.

NON-RESISTIVE ELECTRICAL POTENTIAL DROPS IN COSMICAL PLASMAS

Carl-Gunne Faalthammar Dec. 1979 22 p refs Presented at Workshop on Acceleration Mech. in Astrophys., La Jolla, Calif., 3-5 Jan. 1979

(TRITA-EPP-78-17) Avail: NTIS HC A02/MF A01

Electric potential drops in collisionless magnetized cosmic plasmas can be highly effective in energizing charged particles. In particular this is true for potential drops along magnetic field lines. Until recently such potential drops have almost without exception been considered possible only in situations where anomalous resistivity exists (usually as a consequence of current-driven turbulence). However, experiments in the laboratory show that potential drops of a different nature do exist, and these may be at least as important. Two main types were identified. One is the so-called electric double-layer, where the potential drop is localized to a thin region of only some tens of Debye lengths. The other is a kind of potential drop maintained by the restraining effect of magnetic mirrors on charge carriers. Both types are characterized by the absence of a local relation between electric field and current density, and in both cases the circuit aspect must be taken into account. The potential drops can be associated with varying degrees of high frequency noise. The

distribution functions of the energized particles are different than those characterizing resistivity, classical or anomalous.
Author (ESA)

N79-30044# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics and Fusion Research.
FUSION RESEARCH ACTIVITIES, 1979 Res. and Training Programme on Controlled Thermonucl. Fusion and Plasma Phys. (EUR-NE)
B. Lehnert Jan. 1979 40 p refs
(TRITA-PFU-79-01) Avail: NTIS HC A03/MF A01
The research activities in plasma physics and controlled fusion during 1978 are summarized as well as the plans for continued activites during 1979. The research program includes investigations into plasma-neutral gas interaction and stability, magnetic confinement by schemas being based on a main poloidal field, plasma heating, and reactor technology. Author (ESA)

N79-30045# Siemens A.G., Berlin (West Germany).
HIGH PRESSURE ARCS IN SF6. PART 5: HIGH CURRENT PLASMA AND GASFLOW Final Report
K. Zueckler, P. Huhse, H. Kopplin, and K.-P. Rolff Bonn Bundesmin. fuer Forsch. U. Technol. Aug. 1978 116 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. U. Technol. 5 Vol.
(BMFT-FB-T-78-07-PT-5) Avail: NTIS HC A06/MF A01; Fachinformationszentrum Karlsruhe West Ger., DM 27,75
The behavior of circuit breaker arc discharges in gas flow was electrically and optically investigated in model arrangements. The electrical investigations were carried out by means of test equipment which simulates terminal faults and line shorts. A rotating mirror-camera was used to measure the gas flow and its influence on the arc. The investigation of the gas flow and its effect on the arc quenching showed the importance of the decisive parameters and processes: pressure; flow; clogging effect; and the drift of the arc into the nozzle. The magnetic forces acting on the arc were measured by model investigations. It was possible to describe the arc mathematically by an extended Mayr-equation. The dynamic behavior of the arc, the current-zero, the interaction with the circuit, and important facts correlated with the line shorts were calculated. Author (ESA)

76 SOLID-STATE PHYSICS

Includes superconductivity.
For related information, see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers*.

N79-30046 Pennsylvania State Univ., University Park.
VIBRATIONAL SPECTRA AND CHAIN CONFORMATION OF CRYSTALLINE POLY(VINYLIDENE CHLORIDE) Ph.D. Thesis
Maan-shii Steve Wu 1979 216 p
Avail: Univ. Microfilms Order No. 7915746
The polymer chain conformation of crystalline poly(vinylidene chloride) (PVDC) was the subject of controversy for the past three decades. A combination of techniques has been employed in an attempt to elucidate the preferred conformation of PVDC. Conformational models containing two monomers per translational repeat distance were considered. Calculations of the translational repeat distance and the nonbonded Cl---Cl contact distance between two adjacent CCl2 groups were performed for each of the models. By comparing these results with those derived from X-ray analysis and a theoretical estimation of the minimum nonbonded Cl---Cl contact distance, an initial judgement of the structural feasibility of the models was gained. Infrared and Raman spectra were obtained of PVDC single crystals. In addition, infrared spectra of a largely amorphous sample of PVDC and polarized spectra of an oriented PVDC copolymer are presented.
Dissert. Abstr.

N79-30047 Iowa State Univ. of Science and Technology, Ames.
THE STUDY OF ZrCl BY SELF-CONSISTENT BAND CALCULATION Ph.D. Thesis
Jay Francis Marchiando 1979 64 p
Avail: Univ. Microfilms Order No. 7916204
A nonrelativistic self-consistent electronic band structure calculation was performed on zirconium monochloride using the KKR method. The exchange potential was approximated by the chi alpha method. The compound contains homoatomic layers in the sequence Cl-Zr-Zr-Cl and has the characteristics of a graphite-like two-dimensional metal. A substantial charge transfer toward the metallic layers and away from the loosely bonded halogen layer was found. There is also significant admixture of Zr-d character within the filled Cl-3p bands. A renormalized atom approximation to determine the relative positions of the bands and to estimate the charge transfer occurring in ZrCl was attempted. Dissert. Abstr.

N79-30048 Rhode Island Univ., Kingston.
COHERENT SINGLE-PHONON EFFECTS IN NIOBIUM Ph.D. Thesis
Charles Francis Majkrzak 1978 343 p
Avail: Univ. Microfilms Order No. 7915463
The coherent inelastic scattering of neutrons in polycrystalline niobium via single-phonon processes is reported. The exact theoretical expressions for the coherent one-phonon creation and annihilation cross sections (integral and differential with respect to angle) were numerically evaluated (by computer) over a wide range of incident neutron wavelengths. A comprehensive plan for a source of very low energy neutrons (with velocities as low as several meters per second) is proposed. Given an adequate source, the study of phonon effects can be extended beyond the range of incident neutron wavelengths accessible with the double-axis spectrometer. Dissert. Abstr.

N79-30049 Pittsburgh Univ., Pa.
PROBLEMS IN SOLID STATE PHYSICS AND STATISTICAL MECHANICS Ph.D. Thesis
Jayanth R. Banavar 1978 176 p
Avail: Univ. Microfilms Order No. 7917460
The spin wave problem is worked out for a linear chain of N spins (each of S = 1/2, but the results are valid for arbitrary S), with nearest-neighbor J sub 1 and next-nearest-neighbor J sub 2 exchange interactions for the case in which the first and N-th spins are pinned by the same effective surface anisotropy field. The general problem of resonance in thin insulating films is formulated and solved. The helicity modulus (superfluid density) is evaluated for spin systems in the magnon regime and for an interacting Bose fluid in the Bogoliubov approximation. The phase diagram of the model of Ising spins on a bcc lattice with competing nn and nnn exchange interactions is studied. The problem of an electron in a one-dimensional finite or semi-infinite periodic Kronig-Penney potential with an applied homogeneous electric field is treated. Dissert. Abstr.

N79-30050 Virginia Univ., Charlottesville.
ELECTRON LIFETIMES IN MAGNESIUM Ph.D. Thesis
Robert Lawson Brown 1978 115 p
Avail: Univ. Microfilms Order No. 7916257
De Haas - van Alphen measurements were performed to study electron scattering lifetimes in ultrapure magnesium and in very dilute magnesium alloys. For selected orbits the observed Dingle temperatures (T sub D) were found to be independent of magnetic field direction for fields in the basal plane, whereas in the (1010) plane a strong anisotropy was observed. In pure magnesium T sub D decreased by a factor of five as the field was rotated from the (1120) axis towards (0001), reaching a minimum value of less than 0.08 K which corresponds to an electron lifetime of at least 1.5 x 10 to the 11th power s for these orbits. Anisotropies were also observed in Mg-Cd and Mg-Zn alloys. Mechanisms for the lifetime anisotropy are discussed and it is established that dislocation scattering is the source. The dislocation density of the Mg crystals was characterized experimentally and found to be in the range of 1000 to 10,000/sq cm. The results are compared with previous DHVA studies of dislocations, and with presently available theory, as well as previous lifetime measurements obtained by the electron interference technique. Dissert. Abstr.

N79-30051 Nebraska Univ. - Lincoln.
PIEZOMODULATION SPECTROSCOPY OF MOLECULAR CRYSTALS Ph.D. Thesis
Jack Merski 1979 388 p

Avail: Univ. Microfilms Order No. 7918016

An exploratory piezospectroscopic investigation of exciton and polariton states in molecular crystals was carried out for pyromellitic dianhydride-anthracene (PMDA-A), anthracene, tetracyanoquinodimethane (TCNQ) and1,5-bis(dimethlamino) pentamethinium perchlorate (BDP) systems. Polarized, single modulated piezoreflection spectra were obtained at 298 K for the aforementioned systems using a microspectroreflectometer. Piezoreflection spectra could be obtained as continuous frequency scans over the 15 kK to 45 kK photon energy range. These spectral profiles of the strain induced changes in crystal reflectivity exhibit an effective enhancement in experimental signal-to-noise ratio of spectral resolution relative to that realized in an unmodulated reflection spectrum due to a detection sensitivity of approximately 5 x 10 to the - 6 power. This high sensitivity enhances the diagnositic potential of specular reflection techniques. Dissert. Abstr.

N79-30052 Florida State Univ., Tallahassee.
A DIFFRACTION STUDY OF SUBSTRUCTURE IN DEFORMED BETA CuPd SINGLE CRYSTAL Ph.D. Thesis
Tao-Chieh Yu 1978 126 p
Avail: Univ. Microfilms Order No. 7917096

Diffraction effects due to (110) and (211) stacking faults and antiphase boundaries in the B2 ordered structure for single crystal reflections were calculated and the results were applied to an analysis of peak broadening and peak shifts in various crystal directions in cold worked CuPd. Diffraction analysis included reflections from planes parallel to as well as those inclined to the rolling plane. Peak shapes were analyzed by the Fourier method and the strain and particle size broadening effects were separated employing the Warren-Averbach multiple order procedure. Particle size broadening was found to be highly anisotropic with the effective particle sizes ranging from 65A to 520A, which could be completely accounted for by stacking faults on (110) together with small dislocation cells in the crystals. Antiphasing was found to be insignificant in cold-worked single crystal. Dissert. Abstr.

N79-30053 Kentucky Univ., Lexington.
EFFECTS OF STRIATIONS AND RADIATION INDUCED COMPENSATION ON METAL-SILICON SCHOTTKY BARRIER TUNNEL JUNCTIONS Ph.D. Thesis
James Thomas Wimmers 1978 208 p
Avail: Univ. Microfilms Order No. 7918126

The growth of the zero bias resistance peak in In-Si:n tunnel junctions was studied as a function of irradiation induced compensation. The results were interpreted in terms of the electronic structure of the semiconductor and the effects of periodic variations in the doping density (striations). The junctions, fabricated by cleaving pre-cut bars of heavily doped n-type silicon in a stream of evaporating indium under high vacuum, were irradiated using a 6.25 MeV proton beam. The incremental resistance was measured as a function of bias voltage, both at room temperature and at liquid helium temperatures.
Dissert. Abstr.

N79-30054 California Univ., Davis.
THERMAL CONTACT BETWEEN THE ELECTRON DIPOLE-DIPOLE RESERVOIR AND THE NUCLEAR ZEEMAN SYSTEM Ph.D. Thesis
Khalijah Mohd Salleh 1979 168 p
Avail: Univ. Microfilms Order No. 7917175

The properties and conditions under which thermal contact is established between an electron dipole-dipole reservoir (DDR) and the nuclear Zeeman system (NZS) were studied using diamagnetic substances such as ZnF2. 4H2O doped with 1 and 0.1 at. percent Yb(3+) and Y(C2H5SO4)3(9H2O) doped with 2.8 and 0.28 at. percent Sm(3+) and 2.9 and 0.29 at. percent Nd(3+) were used for the investigation. Experiments were performed at temperatures near 1 K and in magnetic field of about 5 degrees. The main findings show that the strength of the DDR-NZS thermal contact is proportional to the square of the impurity concentration and is stronger in cases when the nuclear spin transition is accompanied by an electron flip flop that causes the DDR to heat up rather than to cool down. On the other hand, the presence of a nuclear saturating RF field appears to gradually weaken the DDR-NZS coupling.
Dissert. Abstr.

N79-30055 Virginia Univ., Charlottesville.
LATTICE DYNAMIC THEORY OF DISLOCATION MOTION Ph.D. Thesis
Stanley Joe Crowley 1978 107 p
Avail: Univ. Microfilms Order No. 7916351

The uniform motion of a straight screw dislocation in a lattice model with nearest-neighbor interactions was investigated for crystals with an isotropic slip system and for crystals with a preferred slip direction. Treating self-consistently the coupling between the highly nonlinear motions in the dislocation core and the motions in the rest of the crystal, solutions are obtained for the atomic positions and the external strain required to maintain uniform motion. Explicit calculations show that large oscillatory displacements occur in a wake behind the moving dislocation, due to the waves emitted by the process of disruption and rearrangement of the atomic bonds in the core. Although the relation between the dynamic Peierls stress and the dislocation core width is not monotonic, it shows a general exponential decrease. Dissert. Abstr.

N79-30056 California Inst. of Tech., Pasadena.
NUCLEAR SPIN DYNAMICS AND THERMODYNAMICS OF PULSED NMR IN SOLIDS Ph.D. Thesis
Douglas Peter Burum 1979 217 p
Avail: Univ. Microfilms Order No. 7917930

Investigations are presented which deal with two basic topics of solid state NMR: coherent averaging of nuclear spin interactions by rf irradiation, and the application of thermodynamics in strongly time dependent interaction frames. An extension of coherent averaging theory called the principle of pulse cycle decoupling is presented. A 52-pulse cycle is used to measure proton chemical shift spectra for polycrystalline ice, C6H12, C5H10 and polyethylene and also to study proton shifts in single crystals of gypsum, (CaSO4) (2H2O). Sources of spin heating are analyzed and methods of eliminating these effects are demonstrated. A calculation is presented of the spin-lattice relaxation time during one basic type of multiple pulse irradiation. A method for determining the first moment of an NMR spectrum is also developed. The techniques are demonstrated using a variety of materials, including CaF2 and C6F6. A simple yet highly flexible pulse sequence generator is described. Dissert. Abstr.

N79-30057 Maryland Univ., College Park.
ANALYSIS OF THE SURFACE STRUCTURE PERFECTION AND MICROHARDNESS OF Al2O3 SINGLE CRYSTALS BY X-RAY DIFFRACTION MICROSCOPY Ph.D. Thesis
Edward Noel Farabaugh, Sr. 1977 157 p
Avail: Univ. Microfilms Order No. 7917373

The Berg-Barrett X-ray technique was applied to the problem of characterizing the surface structure of vapor grown Al2O3 single crystal. A general analysis is given of the accessibility of skew reflections for obtaining X-ray micrographs, of the image distortion which occurs in skew reflections, and of the information which may be usefully obtained about the crystal topography and the internal crystal sub-structure. The internal perfection of single crystals of Al2O3 grown by the vapor growth technique was investigated with the Berg-Barrett and Lang X-ray techniques. The microhardness of the Al2O3 single crystals was investigated by employing Knoop and diamond pyramid indenters. The microhardness anisotropy was determined for /0001/ surfaces.
Dissert. Abstr.

N79-30058 Pittsburgh Univ., Pa.
PLASMON AND QUANTITATIVE AUGER SPECTROSCOPY STUDIES OF SOLIDS Ph.D. Thesis
Anton G. Moldovan 1978 211 p
Avail: Univ. Microfilms Order No. 7917486

Work done concerning plasmon oscillations in transition metals (both theoretical and experimental) is presented. Theoretically, the plasmon dispersion relation using the APW model was calculated. A conclusion of this theoretical work is that periodic crystalline potential induces a band structure for plasmons. Using the experiment results on plasmon oscillation in transition metals, a full description of the behavior of the former along a series as well as across group in these metals is given for the first

time. It is shown that plasmon spectroscopy can give information about the exchange integral in magnetic materials. Several applications of the qAES technique to analyze semiconductor devices, magnetic materials and metallic catalysts are shown.
Dissert. Abstr.

N79-30058 Pittsburgh Univ., Pa.
A MAGNETOTHERMODYNAMIC STUDY OF THE SPIN FLOP BOUNDARY AND BICRITICAL REGION WHICH OCCUR IN ANTIFERROMAGNETIC MnCl2.4(H2O) Ph.D. Thesis
Debora Rae Rutter 1978 314 p
Avail: Univ. Microfilms Order No. 7917494

The bicritical region of the phase diagram of single crystal manganous chloride tetrahydrate was investigated with applied magnetic fields directed along the c-crystallographic axis and along two other directions displaced three and seven degrees toward the c' axis. Measurements of the heat capacity and the variation of the magnetization with temperature were taken for all three orientations of the single crystal at constant applied fields in the range H = 7 to 10 kilogauss and T = 0.5 to 2.0 K. The adiabatic variation of temperature with magnetic field was calculated from this data using the magnetocaloric equation. The phase diagram was constructed for each orientation.
Dissert. Abstr.

N79-30060 Michigan Univ., Ann Arbor.
SUPERFLUID ONSET OF MULTILAYER He-4 FILMS ON ZYX GRAPHITE Ph.D. Thesis
Samuel Efrain Polanco 1979 104 p
Avail: Univ. Microfilms Order No. 7916793

Superfluid onset of multilayer He-4 films on ZYX graphite was studied between 1.0 and 1.8 K by precise, steady-state, thermal transport measurements. Film thermal resistance at constant temperature was measured as the coverage varies through the superfluid transition. Onset transition widths increase with temperature, being more than one layer wide at 1.81 K. The onset thickness increases monotonically with temperature above 1.39 K. However, thermal resistance curves at 1.19 and 1.39 K are observed to be contiguous, with onset at 4.5 layers. Results are shown to be consistent with uniform layer growth until a thickness is reached, and with nucleation of bulk droplets thereafter. Dissert. Abstr.

N79-30061 Kentucky Univ., Lexington.
CONDUCTIVITY TRANSITIONS AND CRITICAL PHENOMENA IN RANDOMLY HETEROGENEOUS MEDIA Ph.D. Thesis
Paul Michael Kogut 1978 134 p
Avail: Univ. Microfilms Order No. 7918098

The randomly heterogeneous conductor is a disordered mixture of materials of differing conductivities. Its behavior with a random resistor network is modelled. Specifically, an infinite lattice of resistors is assumed whose conductivities are chosen at random from the distribution function g(sigma) = p sub a delta (sigma) + p sub b h(sigma) + p sub c delta (sigma - infinity), where delta signifies Dirac's function and h (0) is an arbitrary normalized function. Desk-top experiments and experiments of others, on the critical behavior of randomly heterogeneous conducting media, are discussed. Dissert. Abstr.

N79-30062 Washington Univ., Seattle.
CONDENSATION, COMPRESSION, AND ROTATION OF ARGON MONOLAYERS ADSORBED ON GRAPHITE Ph.D. Thesis
Christopher Gerard Shaw 1979 153 p
Avail: Univ. Microfilms Order No. 7917632

The intensity of low-energy electron diffraction (LEED) spots from argon adsorbed on graphite at temperatures below 50 K shows an abrupt change as the argon vapor pressure is raised, signaling the onset of 2D solid condensation at pressures and temperatures that are consistent with extrapolation from volumetric measurements above 52 K. The incommensurate 2D solid is rotated by a small angle theta from the orientation of a (square root of 3 x the square root of 3) 30 deg registered structure. Precise measurement of the mean lattice constant d from LEED patterns allows the calculation of the 2D isothermal compressibility (at 42 K) of the argon monolayer. The orientation angle theta varies continuously with d, and theta (d) is almost independent of temperature. By measuring the energy dependence of specular LEED beams from bare graphite and from graphite with an adsorbed argon monolayer, the mean overlayer-substrate distance was calculated to be 3.2 plus or minus 0.1 A.
Dissert. Abstr.

N79-30063 Washington Univ., Seattle.
HIGH-PRESSURE STUDY OF ANTIFERROMAGNETIC ORDERING IN GAMMA-Fe Ph.D. Thesis
Chun-Mai Liu 1978 139 p
Avail: Univ. Microfilms Order No. 7917599

The magnetism of face-centered cubic iron (gamma-Fe) under high pressure was investigated in gamma-Fe precipitates in copper and the type 310 stainless steel. The antiferromagnetic ordering was studied by Moessbauer effect. Thermal sean technique was used to determine the Neel temperatures. Results show the Neel temperatures in both alloys decreased with increasing pressure. This contradicts the predictions of popular models for Invar alloys; namely, Kondorsky's localized model and Weiss' two-gamma-state model, but may be explained in terms of band antiferromagnetism. In the case of the gamma-Fe precipitates in copper, the Neel temperature decreased from 45 K at 1 bar to 25 C at 40 kbar, with a rate of -0.5 K/kbar. The Neel temperature of stainless steel 310 decreased from 42 K at 1 bar with nearly the same rate. Dissert. Abstr.

N79-30064 Stanford Univ., Calif.
PHOTOEMISSION STUDIES OF ADSORPTION AND OXIDATION OF SELECTED METALS AND SEMICONDUCTORS Ph.D. Thesis
Jeffrey Noland Miller 1979 246 p
Avail: Univ. Microfilms Order No. 7917261

Photoemission in the energy range between sixteen and six hundred electron volts was applied to the study of electronic structure and of oxidation and adsorption of simple molecules on the surface of platinum, niobium, niobium three tin, amorphous germanium, and amorphous silicon. Dissert. Abstr.

N79-30065# Clemson Univ., S.C. Dept. of Physics and Astronomy.
A STUDY OF CRYSTALLINE DEFECTS AND THEIR TRANSPORT IN ALKALI AZIDES Final Report, Apr. 1975 - Nov. 1978
A. L. Laskar Apr. 1979 77 p refs
(Grant DAHC04-75-G-0130)
(AD-A068117; CUP-201; ARO-13059.3-P) Avail: NTIS HC A05/MF A01 CSCL 20/2

Crystalline defects, their transport and interactions with impurities in potassium and rubidium azides have been studied by measuring the electrical conductivity with ac and dc techniques, the diffusion by a tracer sectioning technique and by the measurement of ionic thermo-current (ITC). Methods were developed to grow large and excellent quality single crystals of KN3 and RbN3 by the Kyropolous and solution growth techniques. The defect structure in both KN3 and RbN3 is determined to be Schottky type. The anisotropy in the ionic transport was studied by measuring the diffusion of Rb(-) in RbN3 parallel and normal to the c-axis. The relaxation modes of the impurity-vacancy dipoles were measured by the ITC technique in KN3 samples doped with Cu(-2), Ca(-2), Co(-2), Pb(-2) and Ni(-2) and in RbN3 samples doped with Ba(2-). The preliminary results of the anisotropic diffusion of Ag(-) in KN3 and anion diffusion experiments are presented. GRA

N79-30066# Colorado State Univ., Fort Collins. Dept. of Physics.
DIELECTRIC-SEMICONDUCTOR INTERFACES OF GALLIUM ARSENIDE AND INDIUM PHOSPHIDE
Larry G. Meiners Apr. 1979 147 p refs
(Contract N00014-76-C-0976; RR0210203)
(AD-A068218; SF19) Avail: NTIS HC A07/MF A01 CSCL 20/12

Capacitance-voltage measurements over a wide frequency range and surface photovoltage measurements were made on GaAs and InP MIS diodes. In GaAs, the surface potential could only be varied about 0.4 eV about a point 0.8-0.9 eV below the conduction band. In contrast, InP displayed a considerably

smaller surface state density and the p-type material could be inverted. GRA

N79-30067# Ballistic Research Labs., Aberdeen Proving Ground, Md.
HMX, PETN, AND TNT REVISITED FOR SINGLE CRYSTAL AND VACUUM DROP WEIGHT SENSITIVITY
James E. Cole Feb. 1979 22 p refs
(DA Proj. 1T6-62603-A-559)
(AD-A069122; AD-E430227; ARBRL-MR-02901) Avail: NTIS HC A02/MF A01 CSCL 09/1

HMX, RDX, PETN, and TNT were tested for impact sensitivity in a drop weight apparatus. The most common drop test found in literature was the impact by drop weight onto multiple crystals of explosive set on sandpaper. We tested on sandpaper and then conducted additional tests on bare metal, with multiple and single crystals and at ambient and in vacuum conditions. HMX and RDX were most extensively examined during the additional test to obtain baseline sensitivity controls for programs contemplated for either sensitizing or desensitizing the explosives. We found sandpaper tests to be too severe compared to bare tool tests which gave us a better explosion point sensitivity spread. Single crystals and vacuum tests consumed too much time without being more definitive. However, these tests did show that the absence of air to form hot spots had little effect on the compound's sensitivity. GRA

N79-30068# Lincoln Lab., Mass. Inst. of Tech., Lexington.
SOLID STATE RESEARCH, 1978:4 Quarterly Technical Summary Report, 1 Aug. - 31 Oct. 1978
Alan L. McWhorter 15 Mar. 1979 74 p refs
(Contract F19628-78-C-0002)
(AD-A068563; ESD-TR-78-287) Avail: NTIS HC A04/MF A01 CSCL 09/3

This report covers in detail the solid state research work of the Solid State Division at Lincoln Laboratory for the period 1 August through 31 October 1978. The topics covered are Solid State Device Research, Quantum Electronics, Materials Research, Microelectronics, and Surface-Wave Technology. GRA

N79-30069# Technische Univ., Vienna (Austria). Inst. fuer Industrielle Elektronix.
INJECTION LIMITED GUNN DEVICES Final Report, Aug. 1978 - Feb. 1979
Ulrich Traxlmayr and H. Thim Feb. 1979 8 p
(Grant DA-ERO-78-G-102; DA Proj. 1T1-61102-BH-5703)
(AD-A069152) Avail: NTIS HC A02/MF A01 CSCL 09/1

As a continuation of our experimental work on epitaxial growth of high quality GaAs and on low resistance ('ohmic') contacts (Grant No. DA ERO-78-G-049) devices with field effect transistor cathode contacts for controlling injection have been fabricated and tested. The theoretically predicted improvements on bandwidth and efficiency have not yet been observed experimentally. On the contrary, performance of the Gunn diode always deteriorated whenever a bias voltage was applied to the gate, although domain formation could be suppressed. The results indicate that the basic concept of using a field effect cathode as the injection limiting contact is correct and that there is reasonable hope that improved operation should be possible with this device if the correct doping density and a sufficiently small gate length is used. GRA

N79-30070# California Univ., Berkeley. Lawrence Berkeley Lab.
COMPUTATIONAL METHODOLOGY IN CRYSTALLOGRAPHY: EVALUATION AND EXTENSION. REPORT OF A WORKSHOP
D. Templeton, ed. and C. Johnson, ed. 1978 98 p refs Workshop held at Asilomar, Calif., 19-22 Jun. 1978
(Contract W-7405-eng-48)
(LBL-7939) Avail: NTIS HC A05/MF A01

Recomendations are presented by the panels on systems, phasing, numerical refinement, graphics, and information retrieval. Abstracts of individual papers presented at the workshop are included. DOE

N79-30071# Sandia Labs., Albuquerque, N. Mex.
ION CHANNELING STUDIES OF HYDROGEN LATTICE LOCATION
S. T. Picraux 1979 7 p refs Presented at Workshop on Analysis of Hydrogen in Solids, Albuquerque, N. Mex., 23 Jan. 1979
(Contract EY-76-C-04-0789)
(SAND-79-0657C; Conf-790127-8) Avail: NTIS HC A02/MF A01

The technique presented was applied to both metals and semiconductors and is particularly valuable when combined with ion implantation for the introduction of hydrogen in the study of hydrogen trapping by defects. DOE

N79-30072# Sandia Labs., Albuquerque, N. Mex.
BANDSTRUCTURE CALCULATIONS FOR METAL HYDROGEN SYSTEMS
A. C. Switendick 1979 49 p refs Presented at Hydrogen in Metals Intern. Meeting, Munster, West Germany, 6 Mar. 1979
(Contract EY-76-C-04-0789)
(SAND-79-0493C; Conf-790301-9) Avail: NTIS HC A03/MF A01

The factors contributing to hydride stability are discussed for a variety of metal hydride systems. The formation of a low-lying hydrogen associated state is a common feature. A significant transition metal character is also found in these states. DOE

N79-30073# Oak Ridge National Lab., Tenn.
DOPANT PROFILE CHANGES INDUCED BY PULSED LASER ANNEALING
C. W. White, W. H. Christie, P. P. Pronko, B. R. Appleton, S. R. Wilson, R. T. Young, J. C. Wang, R. F. Wood, J. Narayan, and C. W. Magee (RCA Labs., Princeton, N. J.) Aug. 1978 11 p refs Presented at Conf. on Ion Beam Modification of Mater., Budapest, 4-8 Sep. 1978
(Contract W-7405-eng-26)
(CONF-780932-7) Avail: NTIS HC A02/MF A01

Secondary ion mass spectroscopy (SIM) and Rutherford ion backscattering were used to investigate the effects of pulsed laser annealing on silicon crystals implanted by B, P, As, Sb, Cu, and Fe. Substantial redistribution is undergone by B, P, As, and Sb in the absence of significant surface segregation during the laser annealing process. Calculations strongly suggest that the crystal can be melted to a depth of 1 micron and the implanted region remains in the melted state for several hundred nanoseconds. Profiles calculated for liquid phase diffusion of the dopant are shown to be in excellent agreement with the experimental results. Arsenic profiles after laser annealing are shown to be very sensitive to the laser photon energy density. Profiles for implanted Cu and Fe show significant segregation to the surface after pulsed laser annealing and this may be related to their very low segregation coefficient from the liquid. DOE

N79-30074# Laboratoire Central de Recherches Thomson-CSF, Orsay (France).
THE USE OF MOLECULAR SPRAYS IN ULTRAHIGH VACUUM FOR GaAs MONOCRYSTALLINE GROWTH APPLICATIONS, VOLUME 2 Final Report [UTILISATION DE JETS MOLECULAIRES EN ULTRAVIDE POUR L'APPLICATION A LA CROISSANCE MONOCRISTALLINE DE GaAs, VOLUME 2]
P. Etienne, G. Bichon, A. Doriath, J. Chaplart, J. Massies, N. T. Linh, H. Derewonko, P. Gibeau, and M. Laviron Nov. 1977 66 p refs In FRENCH 2 Vol.
(Contract DRME-76/34-296)
(LCR-2273-DK-PT-2) Avail: NTIS HC A04/MF A01

A technique for growing GaAs single crystal layers on a semiconducting substrate was improved under laboratory conditions. A molecular spray is used in an ultrahigh vacuum for depositing epitaxial layers. An optimization of the process made possible the reduction of the level of residual doping to p = 2 x 10 to the 14th power/coem with mu = 430 sqcm (1/4) (1/5). Doping was done with tin. With n = 10 to the 17th power/cu cm the mobility is approximately 5000 sq cm/VS. Results led to the construction of low noise field effect transistors with satisfactory dynamic characteristics (at 6 GHz, NF = 2.6 dB with Gass = 9 dB) and excellent static characteristics (elbow voltage 1 V; pinch off voltage 2.5 V; transconductance 150 mmhos/mm). Author (ESA)

N79-30075# Laboratoires d'Electronique et de Physique Appliquee, Limeil-Brevannes (France).
THEORETICAL EVALUATION OF THE FABRICATION OF MONOCRYSTALLINE SILICON RIBBONS GROWN FROM POLYCRYSTALLINE FEED RIBBONS USING A ZONE REFINING TECHNIQUE European Concerted Action, Energie Solaire Final Report [EVALUATION THEORIQUE DE LA REALISATION DE RUBANS DE SILICIUM MONOCRISTALLINS A PARTIR DE RUBANS POLYCRYSTALLINS PAR DEPLACEMENT D'UNE ZONE FLOTTANTE]
Christian Belouet Dec. 1978 33 p refs In FRENCH; ENGLISH summary
(Contract DGRST-76-7-1490)
(LEP-78/661.SME-682-A) Avail: NTIS HC A03/MF A01

A theoretical study of the shape stability, including the thickness of silicon ribbons grown from polycrystalline feed ribbons by a zone refining technique is presented. Conditions derived from a simplified analysis of the shape of the zone edges make use of an equilibrium criterion at the solid-liquid-vapor interface. Results show that for terrestrial photovoltaic applications of self-sustained ribbons the thickness of the regrown and feed ribbons must be similar, i.e. on the order of 100 micrometers. This necessarily implies, for the ribbon source, the choice of both a suitable deposition technique and a removable substrate, as the hot rolling of polycrystalline ingots failed during the course of this research. Author (ESA)

77 THERMODYNAMICS AND STATISTICAL PHYSICS

Includes quantum mechanics; and Bose and Fermi statistics.

For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer*.

N79-30076 City Univ. of New York, N. Y.
APPROXIMATION METHODS FOR THE PARTITION FUNCTIONS OF ANHARMONIC SYSTEMS Ph.D. Thesis
Peter T. Lew 1979 130 p
Avail: Univ. Microfilms Order No. 7916987

The analytical approximations for the classical, quantum mechanical and reduced partition functions of the diatomic molecule oscillating internally under the influence of the Morse potential were derived and their convergences were tested numerically. This successful analytical method is used in the treatment of anharmonic systems. Using Schwinger perturbation method in the framework of second quantization formulism, the reduced partition function of polyatomic systems can be put into an expression which consists separately on contributions from the harmonic terms, the Morse potential correction terms and the interaction terms due to the off-diagonal potential coefficients. The calculated results of the reduced partition functions from the approximation methods on the 2-D and 3-D model systems agree well with the numerical exact calculations. Dissert. Abstr.

N79-30077 Michigan Univ., Ann Arbor.
PRECISION MEASURMENT OF THE DECAY RATE OF ORTHOPOSITRONIUM AS A TEST OF QUANTUM ELECTRODYNAMICS Ph.D. Thesis
David Westfall Gidley 1979 250 p
Avail: Univ. Microfilms Order No. 7916708

A comprensive historical outline of the orthopositronium decay rate measurements and theoretical calculations is presented. Early measurements of lambda in SiO2 powder and in vacuum indicated a (2 + or - 0.1)% discrepancy with both the 1974 calculation and the previous experiments in gases. This result prompted a recalculation of lambda which resulted in a 3% decrease in the theoretical value. Remeasurements in powder and in vacuum along with the measurement of lambda in gases are in agreement with the new theoretical value at the 0.2% level. Dissert. Abstr.

N79-30078 Pittsburgh Univ., Pa.
SIXTH ORDER STUDIES OF QUANTUM ELECTRODYNAMICS Ph.D. Thesis
Hae Yong Park 1978 114 p
Avail: Univ. Microfilms Order No. 7917490

The contributions of five sixth order vertex graphs to the anomalous magnetic moment of the electron are presented. By introducing dispersion relations and four dimensional spherical coordinates, the angular integrations are performed using some simple properties of the Gegenbauer polynomials. The remaining integrations over three variables are done numerically, after the appropriate renormalizations. Some properties of massless quantum electrodynamics are discussed in the coordinate-space formalism. The fourth order vacuum polarization tensor is calculated directly from Feynman rules and compared with that of momentum space. They are not in agreement. The sixth order vacuum polarization tensor is calculated to show the dependence of the results on the order of integrations. These two calculational ambiguities may be attributable to hidden delta functions in the second order vertex correction. Dissert. Abstr.

N79-30079 Maryland Univ., College Park.
MODEL GREEN'S FUNCTIONS AND THE AXIOMS OF QUANTUM FIELD THEORY Ph.D. Thesis
Glenn Eric Johnson 1978 133 p
Avail: Univ. Microfilms Order No. 7917129

Model field theories, each of which satisfies most of the requirements, for a complete relativistic quantum field theory, are constructed. The hierarchy of Green's functions associated with each model are explicitly displayed as products of two-point functions so organized that all the linear Wightman axioms are easily checked. It then becomes possible to explore the difficulties that arise when one attempts to implement various nonlinear axioms, e.g. the cluster property, physical positivity, and Nelson's regularity conditions are implemented and limited forms of positivity, called essential positivities, are developed and explored. The models constructed also permit one to analytically continue from Minkowski to Euclidean space and to make connections with Euclidean field theory. Dissert. Abstr.

N79-30080 Stanford Univ., Calif.
NUMERICAL MODELING OF THERMAL RECOVERY PROCESSES Ph.D. Thesis
Mohamed Yousef Soliman 1979 130 p
Avail: Univ. Microfilms Order No. 7917281

A theoretical investigation of forward combustion in a simulated laboratory combustion tube is presented. A mathematical model was developed that includes the thermal, thermodynamic, and hydrodynamic aspects of the process. In this model, oil is assumed to turn directly, in a fashion similar to Gottfried's assumption. The interpretation of the various computed profiles and the associated phenomena are described. Comparison with other numerical models is included. The developed models can also simulate other thermal recovery processes, such as hot water flooding and steam injection. Results for these processes are presented and briefly discussed. Dissert. Abstr.

80 SOCIAL SCIENCES (GENERAL)

Includes educational matters.

No abstracts in this category.

81 ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

N79-30081# General Services Administration, Washington, D.C.
MANAGEMENT GUIDANCE FOR DEVELOPING AND INSTALLING AN ADP PERFORMANCE MANAGEMENT PROGRAM
Nov. 1978 263 p refs

Avail: NTIS MF A01; SOD HC

A program to improve management and enhance control of the Automatic Data Processing (ADP) function is described. G.Y.

N79-30082# Decisions and Designs, Inc., McLean, Va.
DECISION ANALYSIS AS AN ELEMENT IN AN OPERATIONAL DECISION AIDING SYSTEM, PHASE 5 Final Technical Report, 15 Aug. 1977 - 14 Aug. 1978
Scott Barclay Apr. 1979 56 p refs
(Contract N00014-77-C-0595)
(AD-A068339; PR-78-29-6) Avail: NTIS HC A04/MF A01 CSCL 15/7

This report describes Phase V efforts in the continuing investigation of the theoretical foundations of the decision-analytic model developed for the Office of Naval Research's Operational Decision Aiding Project. The principal issue under consideration was the degree to which the utilization of an incomplete, simple hierarchical model in the Tactical Decision Aid (TACAID) could lead to errors in inference as compared with a more complex Bayesian hierarachical model. Specifically, the more complex model would be designed to make allowances for data dependencies as well as nonstationarity in enemy intent. It was concluded that a simple model can lead to significant and potentially costly errors in inference, and that TACAID should be modified to handle these additional complexities. Concurrent with such modifications, training in the proper use of the more complex TACAID would be mandatory to ensure proper use of the additional capabilities. As part of the current research and developement effort, a situation definition capability, called TACDEF, was implemented for TACAID. GRA

N79-30083# General Accounting Office, Washington, D. C. Community and Economic Development Div.
NATIONAL BUREAU OF STANDARDS NEEDS BETTER MANAGEMENT OF ITS COMPUTER RESOURCES TO IMPROVE PROGRAM EFFECTIVENESS
17 Apr. 1979 68 p refs
(PB-294066/6; CED-79-39) Avail: NTIS HC A04/MF A01 CSCL 05A

Planning, management, and use of computer resources is discussed. Improved computer resources for scientists and administrators greater efforts in requirements studies to demonstrate the need for added computer capabilities and management controls over hardware and software are recommended for program effectiveness along with an effective management system, centralizing computer management and increasing top management involvement. GRA

82 DOCUMENTATION AND INFORMATION SCIENCE

Includes information storage and retrieval technology; micrography; and library science.

For computer documentation see *61 Computer Programming and Software*.

N79-30084# Stanford Univ., Calif. Dept. of Computer Science.
DESIGN AND ANALYSIS OF A DATA STRUCTURE FOR REPRESENTING SORTED LISTS
Mark R. Brown (Yale Univ., New Haven, Conn.) and Robert E. Tarjan Dec. 1978 51 p refs
(Contract N00014-76-C-0688; Grant NSF MCS-75-22870)
(AD-A068231; STAN-CS-78-79) Avail: NTIS HC A04/MF A01 CSCL 12/2

In this paper we explore the use of 2-3 trees to represent sorted lists. We analyze the worst-case cost of sequences of insertions and deletions in 2-3 trees under each of the following three assumption: only insertions are performed; only deletions are performed; deletions occur only at the small end of the list and insertions occur only away from the small end. Our analysis leads to a data structure for representing sorted lists when the access pattern exhibits a (perhaps time-varying) locality of reference. This structure has many of the properties of the representation proposed by Guibas, McCreight, Plass, and Roberts, but it is substantially simpler and may be practical for lists of moderate size. GRA

N79-30085# Air Force Weapons Lab., Kirtland AFB, N. Mex.
PROCEEDINGS: RESOURCE SHARING 2, 22D MILITARY LIBRARIANS WORKSHOP Final Report
Martha C. Adamson Jan. 1979 141 p refs Workshop held at Albuquerque, N. Mexico, 31 Oct. - 2 Nov. 1978
(AF Proj. 9993)
(AD-A069158; AD-E200294) Avail: NTIS HC A07/MF A01 CSCL 05/2

The 22nd Military Librarians Workshop was hosted by the Air Force Weapons Library from 31 Oct. to 2 Nov. 1978 and held at the Albuquerque Convention Center. In attendance were 150 selected military librarians from around the world who continued the discussion of resource sharing begun at the 21st Military Librarians Workshop the previous year. The 22nd Military Librarians Workshop had a decidedly practical emphasis. Among the contributions included here are advice on getting full value from network membership, measuring and evaluating library services, starting an automation project, and predicting the impact of online commercial information systems. Checklists and bibliographies are provided throughout. The recently produced 'Census of Special Resources, a Registry of Locally Developed Specialized Tools for Military Libraries' appears as an appendix. GRA

N79-30086# Army Construction Engineering Research Lab., Champaign, Ill.
THE BASELINE INFORMATION SYSTEM: USERS MANUAL Final Report
B. A. Griffin and R. D. Webster Apr. 1979 22 p refs
(DA Proj. 4A7-62720-A-896)
(AD-A069324; CERL-TR-N-72) Avail: NTIS HC A02/MF A01 CSCL 09/2

The Baseline Information System (BLIS) is an extension of the Environmental Impact Computer System (EICS) and a subsystem of the Environmental Technical Information System (ETIS). BLIS was developed to provide EICS users with site-specific data or to identify for EICS users possible sources of such data. This BLIS data base was developed by: Aggregating EICS attribute identifications with common technological bases into search terms; Compiling and analyzing directories of regional experts and conservationists, universities, and existing data management systems; Developing a data file which identifies the aggregate keyword designation, the EICS attributes pertaining to the keyword, points of contact and appropriate geographic/political references; Developing a user-oriented software package for inclusion into ETIS. This report provides BLIS user instructions and serves as a guide for the retrieval and use of appropriate points of contact or consultation for environmental baseline data. GRA

N79-30087# QEI, Inc., Bedford, Mass.
REVIEW OF OPTIONS REGARDING THE FUTURE OPERATION OF THE DOE/RECON SYSTEM AND THE MARKETING OF INFORMATION PRODUCTS OF THE DOE TECHNICAL INFORMATION SYSTEM
J. W. Kuipers, F. W. Lancaster, and R. W. Thorpe 15 Sep. 1978 116 p refs
(Contract EU-78-C-01-6182)
(QEI-8915) Avail: NTIS HC A06/MF A01

Problems of the DOE/RECON system and DOE/TI information marketing are addressed, and the role of DOE/TI activities in the overall DOE information transfer process is discussed. Factors to be considered in a pricing policy for DOE/TI information products are examined. It is recommended that the costs to produce basic technical reports and secondary information products be assumed by DOE, but that costs of value-added services be assumed partially or completely by product users. It is also recommended that for a trial period of not more than two years, the DOE/RECON system be operated as at present and that provision be made for the on-line distribution of the EDB and GAP files as public files on commercial vendor systems; costs of public files would be borne by the users. If commercial vendors elect not to distribute the EDB and GAP files, then they should be mounted as private files on a selected commercial system with costs shared by DOE and system users. DOE

N79-30088# Department of Energy, Oak Ridge, Tenn. Technical Information Center.
ENERGY INFORMATION DATA BASE. SERIAL TITLES, SUPPLEMENT 3
Dec. 1978 80 p refs
(TID-4579-R10-Suppl-3) Avail: NTIS HC A05/MF A01

Changes and additions to TID-4579-R10 (the authority list for serial titles used by TIC) are contained in this supplement. The supplement is intended to be used with that publication. DOE

N79-30089# Paris-Sud Univ., Orsay (France). Lab. de Physique des Plasmas.
ACTIVITIES REPORT ON THE DATA BASE GAPHYOR FOR 1978-1979 Annual Report, 1978 [RAPPORT D'ACTIVITE GRAPHYOR - ANNEE 1978- ET PROJETS POUR 1979]
J. L. Delcroix Dec. 1978 18 p In FRENCH
(LP-11) Avail: NTIS HC A03/MF A01

The data base, GAPHYOR, is presented as an automatic documentation system containing information on the properties of atoms and molecules. Data available includes energy levels, half lives, dipolar moments, polarizability as well as data on interaction properties between particles and macroscopic properties of the corresponding gases and plasmas. User requirements are discussed and ways in which GAPHYOR can be helpful are suggested. Improvements being made on the system are also reviewed in detail. Author (ESA)

N79-30090# Research Inst. of National Defence, Stockholm (Sweden).
MULTISPECTRAL SCANNER DATA HANDLING AND DATA PROCESSING
S. I. Aakersten, L-E. Gustafsson, and T. Orghaug Aug. 1978 90 p refs Sponsored in part by Swed. Board for Space Activity (DFR)
(FOA-A-30019-E1) Avail: NTIS HC A05/MF A01

Data handling and computer aided data processing of the 10 channel multispectral analog data acquired during the airborne multispectral scanner project conducted in the summer of 1975 (MSS-75 project) are described. Radiometric and geometric data quality is discussed. Data analysis (supervised classification) is treated in some detail and the benefit of performing classification in feature-transformed space is analyzed partly using real data. It is shown empirically that computer CPU-time is linearly dependent on channel number compared with an approximate quadratic dependence for the classical method. Author (ESA)

N79-30091# King Research, Inc., Rockville, Md.
INTERACTIONS BETWEEN SCIENTISTS AND THE JOURNAL PUBLISHING PROCESS Final Report
Dennis McDonald Jan. 1979 291 p refs
(Grant NSF DSI-77-17943)
(PB-293990/8) Avail: NTIS HC A13/MF A01 CSCL 05I

Mail surveys were conducted with authors and subscribers of The Astrophysical Journal and authors of Cancer Research. Respondents were asked to identify two other journals similar to these journals. Respondents then supplied data on their experience with all three journals and their perceptions of the journals. Data were analyzed to investigate authors' selection of journals to which to submit articles and subscribers' selection of journals for subscribing. Multi-attribute utility models were constructed to generate measures of relative journal value for individual respondents. GRA

83 ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

N79-30092# Strasbourg Univ. (France). Bureau d'Economie Theorique et Appliquee.
STUDY OF THE ECONOMIC IMPACT OF ESA CONTRACTS. FEASIBILITY STUDY Final Report [L'UTILITE ECONOMIQUE DES CONTRATS DE L'ESA: ETUDE DE FAISABILITE]
Patrice Brendle, Patrick Cohendet, Regis LaruedeTournemine, Helwig Schmied, and Daniel Vitry Paris ESA Sep. 1978 32 p refs In FRENCH
(Contract ESA-3564/78-F-DKR(SC))
(ESA-CR(P)-1157) Avail: NTIS HC A03/MF A01

The economic impact of ESA policies on the competitiveness of European industries in a world market was analyzed both for the collective effect of ESA contracts and for the specific case of the METEOSAT Project. Results show an improvement in the export market for the member states as a direct result of work done for ESA. There is also an improvement in the percentage of substitution of European manufactured goods for imported items, also attributable to ESA influence. Given the present state of the member states industries, a feasibility study shows that the METEOSAT Project will also have a positive impact on economic development in Europe. Author (ESA)

84 LAW AND POLITICAL SCIENCE

Includes space law; international law; international cooperation; and patent policy.

N79-30093# Committee on Commerce, Science, and Transportation (U. S. Senate).
NASA AUTHORIZATION FOR FISCAL YEAR 1980, PART 3
Washington GPO 1979 558 p refs Hearings on S. 357 before the Comm. on Commerce, Sci., and Transportation, 96th Congr., 1st Sess., 2, 14-15 Mar.; 1 May and 4 Jun. 1979
(GPO-44-885) Avail: Comm. on Commerce, Sci., and Transportation

Testimonies, primarily from NASA (National Aeronautics and Space Administration) witnesses, before the Committee on Commerce, Science, and Transportation (United States Senate) are documented. The hearing was held to authorize appropriations to NASA for research and development, construction of facilities, research and program management, and for other purposes for FY-80. G.Y.

85 URBAN TECHNOLOGY AND TRANSPORTATION

Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.

For related information see *03 Air Transportation and Safety, 16 Space Transportation,* and *44 Energy Production and Conversion.*

N79-30094 Tulane Univ., New Orleans, La.
AN INVESTIGATION INTO THE USE OF HIGH PURITY OXYGEN IN THE TREATMENT OF DOMESTIC AND INDUSTRIAL WASTEWATERS Ph.D. Thesis
John Michael Dantoni 1978 428 p
Avail: Univ. Microfilms Order No. 7918712

High purity oxygen is widely accepted as an alternate means of aeration in the activated sludge process, with numerous successful installations. However, researchers raised a number of questions as to the true benefits of operating the activated sludge process at elevated dissolved oxygen levels. The results of a series of forty-eight activated sludge batch tests and sixteen continuous flow runs demonstrate the advantages of utilizing elevated oxygen levels for systems operating with high organic and solids loadings. These advantages were not realized in parallel tests conducted at normal or low load conditions. Dissert. Abstr.

N79-30095 International Institute for Applied Systems Analysis, Laxenburg (Austria).
SYSTEMS ASSESSMENT OF NEW TECHNOLOGY: INTERNATIONAL PERSPECTIVES
G. M. Dobrov, ed., R. H. Randolph, ed., and W. D. Rauch, ed. Aug. 1978 100 p refs Presented at IIASA Workshop, Laxenburg, Austria, 18-22 Jul. 1977

(IIASA-CP-78-8) Avail: Issuing Activity

Several aspects of Technology Assessment (TA) and Systems Assessment of New Technology (SANT) are discussed in terms of international cooperation. For individual titles, see N79-30096 through N79-30101.

N79-30096 International Institute for Applied Systems Analysis, Laxenburg (Austria).

TOWARD EFFECTIVE INTERNATIONAL TECHNOLOGY ASSESSMENTS

K. Chen and L. Zacher *In its* Systems Assessment of New Technol. Intern. Perspectives Aug. 1978 p 1-12 refs (For primary document see N79-30095 20-85)

Avail: Issuing Activity

Technology assessments are defined as policy oriented systematic studies of the social impacts and the social management of science and technology. The importance of international cooperation in this field is discussed. The contextual dimension of TA is explained, a crossnational comparison example is analyzed, and an agenda for future work is presented. Author (ESA)

N79-30097 International Institute for Applied Systems Analysis, Laxenburg (Austria).

A STRATEGY FOR ORGANIZED TECHNOLOGY

G. M. Dobrov *In its* Systems Assessment of New Technol. Intern. Perspectives Aug. 1978 p 13-30 refs (For primary document see N79-30095 20-85)

Avail: Issuing Activity

It is noted that the theoretical and methodological elements necessary to international cooperation in setting science and technology (ST) policy are absent or inappropriate. National and international ST policy making is discussed establishing definitions and strategic concepts. Author (ESA)

N79-30098 International Institute for Applied Systems Analysis, Laxenburg (Austria).

SOCIAL ASSESSMENT OF TECHNOLOGY AND SOME OF ITS INTERNATIONAL ASPECTS

F. Hetman *In its* Systems Assessment of New Technol. Intern. Perspectives Aug. 1978 p 31-44 refs (For primary document see N79-30095 20-85)

Avail: Issuing Activity

Social assessment of technology (SAT) is defined and its applications explored. The concept of SAT, leading to a reappraisal of the role of science and technology, is developed. The interplay of factors is presented as a threefold system that integrates the processes of analysis, decision making, and information into one dynamic continuum. Institutional status and current programs are discussed. Author (ESA)

N79-30099 International Institute for Applied Systems Analysis, Laxenburg (Austria).

EXPERIENCE IN MULTINATIONAL FORECASTING OF ADVANCES IN SCIENCE AND TECHNOLOGY

V. Glushkov, G. M. Dobrov, V. Maksimenko, and Y. Ershov *In its* Systems Assessment of New Technol. Intern. Perspectives Aug. 1979 p 45-60 refs (For primary document see N79-30095 20-85)

Avail: Issuing Activity

A review of work done by member countries in the Council for Mutual Economic Assistance (CMEA) in the area of scientific and technological forecasting is presented. Author (ESA)

N79-30100 International Institute for Applied Systems Analysis, Laxenburg (Austria).

TECHNOLOGY ASSESSMENT FOR INTERNATIONAL AND NATIONAL TECHNOLOGY TRANSFER

H. Maier *In its* Systems Assessment of New Technol. Intern. Perspectives Aug. 1978 p 61-66 refs (For primary document see N79-30095 20-85)

Avail: Issuing Activity

The role of Systems Assessment of New Technology (SANT) in the transfer of research and development work into production, in socialist countries, is reviewed. Author (ESA)

N79-30101 International Institute for Applied Systems Analysis, Laxenburg (Austria).

POSSIBILITIES AND NEEDS FOR DATA BASES FOR SANT WITH SPECIAL REFERENCE TO THE INTERNATIONAL LEVEL

W. D. Rauvch *In its* Systems Assessment of New Technol. Intern. Perspectives Aug. 1978 p 67-84 refs (For primary document see N79-30095 20-85)

Avail: Issuing Activity

The data base aspect of Systems Assessment of New Technology (SANT) is discussed. Needs are classified in terms of management requirements. Types of influence relevant to SANT are described. Special problems on the international level and a list of international computerized data banks are presented.

Author (ESA)

N79-30102# Department of Energy, Washington, D. C.

ENVIRONMENTAL READINESS DOCUMENT: URBAN WASTE ENERGY RECOVERY. COMMERCIALIZATION PHASE 3 PLANNING

Sep. 1978 28 p refs

(DOE/ERD-0002) Avail: NTIS HC A03/MF A01

Environmental Readiness Documents are prepared periodically to review and evaluate the environmental status of an energy technology during the several phases of development of that technology. Through these documents, an independent and objective assessment of the environmental risks and potential impacts associated with the extensive use of the technology is provided. This document was prepared to assist the DOE Commercialization Task Force on Urban Waste Energy Recovery to evaluate the commercial readiness of this technology with respect to environmental issues. An effort was made to identify potential environmental problems that may be encountered based upon current knowledge, proposed and possible new environmental regulations and the uncertainties inherent in planned environmental research. G.Y.

N79-30103# Barber-Nichols Engineering Co., Arvada, Colo.

MECHANICAL INTERFACE FOR AN ELECTRIC PROPULSION TEST BED Final Report

Ralph W. Blakemore Feb. 1979 166 p refs

(Contract DAAK70-78-C-0055)

(AD-A069070) Avail: NTIS HC A08/MF A01 CSCL 21/3

As a result of the test bed/MERADCOM dc propulsion system optimization process, two configurations appear to be reasonable choices from a performance standpoint. The fundamental differences lie in the placement of the driver axle and electric propulsion system components. The rear wheel drive configuration is considered the optimum, primarily due to a slight performance advantage. Highlights of both configurations are: Two speed involute tooth form electro-mechanically shifted transmission, 10:1 primary drive ratio and 5:1 final drive ratio; high capacity drum brakes with regenerative brake coupling; de Dion drive axle suspension with independent coil or torsion spring suspension on non-drive wheels (battery trays integral with suspension support frame); radial construction tires; four occupant interior capacity; 229-239 centimeter wheel base; virtually no requirement for routine maintenance; conventional occupant safety equipment retained; performance capability exceeds the requirements of the SAE; J227a schedule 'D' driving cycle with either 108 volt dc or 132 volt dc electric propulsion systems. GRA

N79-30104# Carnegie-Mellon Univ., Pittsburgh, Pa. Management Sciences Research Group.

A SINGLE SOURCE TRANSPORTATION ALGORITHM

Robert V. Nagelhout and Gerald L. Thompson Feb. 1979 36 p refs

(Contract N00014-75-C-0621)

(AD-A068237; MSRR-429; WP-41-78-79) Avail: NTIS HC A03/MF A01 CSCL 12/2

A single source transportation problem is an ordinary transportation problem with the additional requirement that the entire demand at each demand location be supplied from a single supply location. It is a special case of Ross and Soland's generalized assignment problem. Such problems occur frequently in applications. This paper gives two heuristic solution methods and a branch and bound algorithm for solving single source transportation problems. A discussion of the branching rules, variable fixing rules, and the computation of weak lower bounds is given. Computational experience with the solution of ran-

domly generated problems having up to 40,000 integer variables is reported. GRA

N79-30105# Canterbury Univ., Christchurch (New Zealand).
ENERGY RECOVERY AND CONSERVATION BY RECYCLING MUNICIPAL SOLID WASTE M.S. Thesis
Barbara Rouse (Lincoln Coll.) and David Lindley New Zealand Energy Res. and Develop. Comm. Oct. 1978 38 p refs
(NZERDC-P7; ISSN-0110-5388) Avail: NTIS HC A03/MF A01

The utilization of recycled materials as energy sources for 2% of the industrial energy in New Zealand is presented. Plans for expanding this program into other energy consuming areas is considered. DOE

N79-30106# Purdue Univ., Lafayette, Ind. Inst. for Interdisciplinary Engineering Studies.
FACTORS AFFECTING THE COMMERCIALIZATION OF ELECTRIC AND HYBRID VEHICLES
Oct. 1978 185 p refs
(Contract EC-77-S-02-4250)
(COO-4250-02) Avail: NTIS HC A09/MF A01

Factors affecting commercialization of electric and hybrid vehicles (ehv) were investigated, and the economic and financial aspects of the commercialization process were evaluated. Societal institutions which can both help and hinder acceleration of commercialization were studied. The role of the DOE ehv demonstration program in promoting this commercialization was examined. DOE

N79-30107# Market Facts, Inc., Washington, D. C.
ELECTRIC HYBRID VEHICLES FOCUS GROUP RESEARCH
Aug. 1978 39 p refs
(Contract EV-78-C-01-6458)
(DOE/TIC-10009) Avail: NTIS HC A03/MF A01

The evaluation of barriers and opportunities associated with successful commercialization of electric hybrid vehicles, and the evaluation of appropriate Federal actions for promoting and facilitating commercialization of these vehicles is presented. Whether electric hybrid vehicles represent the appropriate alternative technology for DOE commercialization efforts is emphasized. DOE

N79-30108# Navy Personnel Research and Development Center, San Diego, Calif.
FEDERAL LABORATORY CONSORTIUM FOR TECHNOLOGY TRANSFER. FAR WEST REGION LOCAL GOVERNMENT ASSISTANCE TASK FORCE Progress Report
C. F. Miller, ed. and A. A. Sjoholm, ed. Dec. 1978 43 p
(Contract W-7405-eng-48)
(UCID-18037-79-1; PR-1) Avail: NTIS HC A03/MF A01

The Far West Region Local Government Assistance Task Force is a current demonstration project of the Federal Laboratory Consortium. It is directed toward the analysis of the needs and problems experienced by public administrators as a result of the budget cuts necessitated by Proposition 13, and the intensification of Federal Laboratory assistance in arriving at appropriate solutions. The background purposes, organization, and activities of the Task Force as well as plans for the coming year are described. DOE

N79-30109# Sandia Labs., Albuquerque, N. Mex.
EVALUATION OF TUFF AS A WASTE ISOLATION MEDIUM
L. D. Tyler 1979 20 p refs Presented at the Symp. on Waste Management and Fuel Cycles, Tucson, Ariz., 28 Feb. 1979
(Contract EY-76-C-04-0789)
(SAND-79-0402C; Conf-790204-8) Avail: NTIS HC A02/MF A01

The occurrence and geologic/hydrologic setting of tuff are discussed. The properties of the rock are compared with other isolation media. The favorable aspects are presented. Unresolved issues are described along with the investigative program for addressing these issues. DOE

N79-30110# UOP, Inc., San Diego, Calif. Fluid Systems Div.
REVERSE OSMOSIS RENOVATION OF SECONDARY EFFLUENT Final Report
James E. Beckman Apr. 1979 61 p refs
(Grant EPA-R-802004)
(PB-293761/3; EPA-600/2-79-086) Avail: NTIS HC A04/MF A01 CSCL 13B

A demonstration of the performance and economics of reverse osmosis treatment of municipal secondary effluent on a sufficient scale to project large plant costs was attempted. The desalted effluent was blended with additional secondary effluent and used for irrigation through an existing irrigation system. A plastic-lined evaporation pond was constructed for brine disposal during the project. A demonstration of reverse osmosis renovation of secondary effluent at the Southside Water Reclamation Facility of the City of Escondido, California is reported. GRA

N79-30111# Design Alternatives, Inc., Washington, D. C.
PROCEEDINGS OF WORKSHOP ON APPROPRIATE TECHNOLOGY Final Report
1979 349 p refs Workshop held 23-25 Jan. 1978
(Contract NSF C-ERS-77-21824)
(PB-294030/2; NSF/RA-79002) Avail: NTIS HC A15/MF A01 CSCL 05A

Recommendations for a research agenda and program guidelines are presented which could be considered in planning a distinct research program which considers technical-social factors and seeks to optimize solutions wherever possible, through reliance on local problem-solving capabilities as well as sensitivity to environmental and cultural impacts. Background information about the issues examined during the project including copies of the project overview and overview of workshop events is presented along with the 25 final papers written by workshop facilitators and participants. The agenda recommends three main research models; sociotechnical systems research, policy research, and technology transfer research. GRA

N79-30112# Georgia Inst. of Tech., Atlanta. Dept. of Social Services.
FRAMEWORKS AND FACTORS AFFECTING INTEGRATION WITHIN TECHNOLOGY ASSESSMENTS. EXECUTIVE SUMMARY Final Report
Frederick A. Rossini, Alan L. Porter, Patrick Kelly, and Daryl E. Chubin Dec. 1978 42 p refs 2 Vol.
(Grant NSF ERS-76-04474)
(PB-294607/7; NSF/PRA-7604474/1) Avail: NTIS HC A03/MF A01 CSCL 05A

Findings of a study of integration of disparate knowledge sources in preparing a technology assessment (TA) are presented. The data were derived from field interviews, analysis of project reports, and small group experiments. These data indicate that a number of factors bear on interdisciplinary interactions in TA: organizational influences; organizational and physical distances; leadership characteristics; team characteristics; motivations and rewards; epistemological distances; value divergences; bounding; iteration, and communication patterns. Four distinctive approaches to foster TA integration were identified. Evidence strongly supports the need for a democratic/facilitating leadership who encourages group communication, especially in the crucial final phase. GRA

N79-30113# Georgia Inst. of Tech., Atlanta. Dept. of Social Sciences.
FRAMEWORKS AND FACTORS AFFECTING INTEGRATION WITHIN TECHNOLOGY ASSESSMENTS. REPORT AND APPENDICES Final Report
Frederick A. Rossini, Alan L. Porter, Patrick Kelly, and Daryl E. Chubin Dec. 1978 105 p refs 2 Vol.
(Grant NSF ERS-76-04474)
(PB-294608/5; NSF/PRA-7604474/2) Avail: NTIS HC A06/MF A01 CSCL 05A

In order to provide technology assessment (TA) practitioners with practical information and recommendations on how to achieve integration, a predominantly exploratory (rather than a strict hypothesis-testing) study was conducted. The task was to identify the essential factors that determined how a study team interacted so as to produce a more or less integrated TA. GRA

N79-30114# George Washington Univ., Washington, D. C. School of Engineering and Applied Science.
ENHANCEMENT OF MUNICIPAL FERROUS WASTE

RECYCLING THROUGH DIRECT FOUNDRY APPLICATION
C. M. Gilmore, A. H. Purcell, M. A. Iman, and A. F. Kremer
Dec. 1978 24 p refs
(Grant NSF AER-76-82249)
(PB-294003/9; NSF/RA-790001) Avail: NTIS HC A02/MF A01 CSCL 11F

Charges of magnetically separated municipal ferrous waste (MFW) were fed directly into a crucible foundry furnace mixed with varying fractions of stock and scrap cast iron. Mechanical testing of cast specimens with up to 50 weight percent MFW revealed sound structures with strengths equal to those of standard cast specimens composed wholly of normal material. The recycled material from this experimental process appears to be useful for many cast iron applications. This research was performed at a working foundry using separated ferrous scrap from the National Center for Resource Recovery facility in Anacostia. The simplicity of the technology involved and its direct compatibility with established materials handling facilities indicates that such technology could be applied on small or large scales in a variety of waste recycling environments. GRA

N79-30115# Connecticut Dept. of Transportation, Wethersfield. Bureau of Planning and Research.
USE OF WASTE MATERIAL IN TRANSPORTATION CONSTRUCTION PROJECTS, REPORT 1
James Malcolm Sime Oct. 1978 64 p refs Sponsored in part by DoT
(PB-294244/9; Rept-466-1-78-12) Avail: NTIS HC A04/MF A01 CSCL 13B

Connecticut's solid waste in transportation construction projects was studied. The possible use of various municipal solid wastes in Sanitary Landfilled Earth Waste Structures (SLEWS) was examined. The extent of waste in Connecticut that could be used in SLEWS construction, delineate the environmental benefits and disadvantages of the SLEWS concept, and define the engineering, construction and specification changes needed to implement SLEWS construction in Connecticut's limited access interstates and primary rights of way are discussed. GRA

N79-30116# American Association for the Advancement of Science, Washington, D.C. Office of Public Sector Programs.
COMMUNITY AND ECONOMIC DEVELOPMENT
1979 187 p refs Presented at the Workshop Considering Probl. Identified by the Intergovernmental Sci., Eng., and Technol. Advisory Panel, 16-18 Nov. 1978, Elkridge, Md.
(Grant NSF OPA-78-24464)
(PB-294593/9; NSF/RA-790042) Avail: NTIS HC A09/MF A01 CSCL 13B

State and local growth and adjustment patterns, neighborhood development and stability, and central city business development are discussed. The problem areas are described in terms of problem statement and problem restatement by the planning group. GRA

88 SPACE SCIENCES (GENERAL)

No abstracts in this category.

89 ASTRONOMY

Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

N79-30117 Washington Univ., Seattle.
AN OPTICAL AND RADIO SURVEY OF THE NUCLEI OF BRIGHT GALAXIES Ph.D. Thesis
Timothy Martin Heckman 1978 256 p
Avail: Univ. Microfilms Order No. 7917577

Spectrophotometric observations obtained with the Intensified Image Dissector Scanner on the 2.1 m telescope of the Kitt Peak National Observatory and radio continuum measurements at 4885 and 1480 MHz obtained on the Very Large Array of the National Radio Astronomy Observatory are presented and interpreted for an optically complete sample of roughly 100 nuclei of bright (nearby) galaxies. The natures of the stellar continuum, emission lines, and radio sources are explored. Dissert. Abstr.

N79-30118 Princeton Univ., N. J.
HD93521 AND THE LOCAL HIGH LATITUDE INTERSTELLAR MEDIUM Ph.D. Thesis
John Alden Reimer Caldwell 1979 146 p
Avail: Univ. Microfilms Order No. 7918553

Ultraviolet spectroscopic observations of the interstellar gas between the sun and the distant, high latitude O star HD93521 were obtained. The column densities of a number of interstellar gaseous species as a function of radial velocity were determined by profile fitting the data, and earlier visual and radio data for this line of sight. The volume densities, gas phase abundances, and other physical conditions parameters of the gas were derived. A comparison with the areal information about the high galactic latitude sky provided by 21 cm mapping, soft X-ray mapping, and the recurrence of particular velocity components in interstellar absorption toward other stars enabled a model for the local high latitude interstellar medium to be formulated.
Dissert. Abstr.

N79-30119 Pittsburgh Univ., Pa.
DEVELOPMENT OF THE IMAGE TRAILER, A PROTOTYPE OF THE MULTICHANNEL ASTROMETRIC PHOTOMETER Ph.D. Thesis
John William Stein 1978 82 p
Avail: Univ. Microfilms Order No. 7917502

The Multichannel Astrometric Photometer (MAP) is discussed; it is a device to be used for the measurement of stellar image positions in the telescope's focal plane. The design of a one channel version, the Image Trailer, is described, and field test results are discussed. Data obtained from trail plates and the Image Trailer are presented. Dissert. Abstr.

N79-30120*# National Aeronautics and Space Administration, Washington, D. C.
INTERNATIONAL ULTRAVIOLET EXPLORER (IUE) POST LAUNCH REPORT 2
16 Aug. 1979 9 p refs
(NASA-TM-80471; S-868-78-03; Rept-2) Avail: NTIS HC A02/MF A01 CSCL 03A

The International Ultraviolet Explorer (IUE), an Explorer class ultraviolet astronomy mission, is an international cooperative program between the United States, the United Kingdom (UK), and the European Space Agency (ESA) which provides for a single launch into geosynchronous orbit to conduct spectral distribution studies of celestial and solar system ultraviolet sources. The spacecraft and scientific instruments were designed and fabricated at the Goddard Space Flight Center. The spectrograph camera was provided by the UK; ESA provided the solar array as well as the European ground station. The IUE observatory system was designed to functionally resemble a ground-based optical observatory at which guest observers could execute observing programs in real time. Observatory performance substantially exceeded design and mission objectives. The secondary mission objectives were also met. G.Y.

N79-30121*# Michigan Univ., Ann Arbor.
SPECTROPHOTOMETRY OF MICHIGAN-TOLOLO QUASARS
David W. Lewis, Gordon M. MacAlpine, and Daniel W. Weedman (Vanderbilt Univ.) 9 Apr. 1979 38 p refs
(Grant NGR-23-005-464)
(NASA-CR-158873) Avail: NTIS HC A03/MF A01 CSCL 03A

Emission-line quasar characteristics are confirmed for 80% of the objects observed, including at least four new quasars with spectral features indicative of supernova-like outflow. Approximately 73% of the redshifts predicted from the discovery plates are found accurate with a mean error in z of 0.03, and a large range of z (from about 0.1 to 3.16) is represented in the sample. The observed redshift distribution for quasars is marginally consistent with a constant co-moving quasar density above z approximately 2.0. The shape of the redshift distribution may

be used as an isotropy probe with a cosmic time resolution of a few times one-hundred million years in the early universe; therefore, continued surveys of this sort are important even if accurate magnitudes are not determined. A.R.H.

N79-30122# Laboratorio di Ricerca e Technologia per lo Studio del Plasma nello Spazio, Frascati (Italy).
MULTI-COLOR DETECTION SYSTEM FOR ASTRONOMICAL OBSERVATIONS IN THE INFRARED RANGE
D. Lorenzetti Dec. 1978 20 p refs
(LPS-78-16) Avail: NTIS HC A02/MF A01

An optical device that permits the simultaneous detection of several infrared bands was studied. A description of the apparatus and experimental results on multicolor wideband detection are presented. The advantages of a multicolor photometer with the traditional instrument are emphasized. Author (ESA)

90 ASTROPHYSICS

Includes cosmology; and interstellar and interplanetary gases and dust.

No abstracts in this category.

91 LUNAR AND PLANETARY EXPLORATION

Includes planetology; and manned and unmanned flights.

For spacecraft design see *18 Spacecraft Design Testing, and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

N79-30123*# National Aeronautics and Space Administration, Washington, D. C.
MARS: THE VIKING DISCOVERIES
Bevan M. French Oct. 1977 37 p refs Original contains color illustrations
(EP-146) Avail: NTIS MF A01; SOD HC $1.50 CSCL 03B

The Viking spacecraft are described as well as the instruments carried to accomplish the combined goal of studying the atmosphere and geology of the entire planet, and to analyze the Martian soil and search for life in two specific locations. Imagery received from the spacecraft illustrate discussions of the planetary surface, composition, and winds. Suggestions for further reading are included along with a list of available NASA film. Experiments and activities for classroom use are described. A.R.H.

N79-30124*# National Aeronautics and Space Administration, Washington, D. C.
REPORT OF THE COMET SCIENCE WORKING GROUP Executive Summary, Oct. 1978 - Apr. 1979
Aug. 1979 13 p Prepared by JPL
(NASA-TM-80542) Avail: NTIS HC A02/MF A01 CSCL 03B

Scientific objectives and mission strategies for a flyby of Halley's comet and rendezvous with Tempel-2 are discussed. Instrumentation to be carried by both the rendezvous spacecraft and the coma probe payload are listed. Known characteristics of both comets are summarized. A.R.H.

N79-30125*# National Aeronautics and Space Administration, Washington, D. C.
REPORT OF THE COMET SCIENCE WORKING GROUP
Aug. 1979 130 p refs Prepared by JPL
(NASA-TM-80543) Avail: NTIS HC A07/MF A01 CSCL 03B

General scientific questions and measurement objectives that can be addressed on a first comet mission relate to: (1) the chemical nature and the physical structure of comet nuclei as well as the changes that occur as functions of time and orbital position; (2) the chemical and physical nature of the atmospheres and ionospheres of comets, the processes which occur in them, and the development of these atmospheres and ionospheres as functions of time and orbital position; and (3) the nature of comet tails, the processes by which they are formed, and the interaction of comets with the solar wind. Capabilities of the various instruments required are discussed. A.R.H.

92 SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots.

N79-30126# Los Alamos Scientific Lab., N. Mex.
SOLAR WIND HEAVY IONS FROM ENERGETIC CORONAL EVENTS
S. J. Bame 1978 10 p refs Presented at the 4th Intern. Conf. on Solar Wind, Burghausen, W. Germany, 28 Aug. 1978 (Contract W-7405-eng-36)
(LA-UR-3044; Conf-780890-1) Avail: NTIS HC A02/MF A01

Ions heavier than those of He can be resolved in the solar wind with electrostatic E/q analyzers when the local thermal temperatures are low. Ordinarily this condition prevails in the low speed solar wind found between high speed streams, i.e. the interstream, IS, solar wind. Various ions of O, Si and Fe are resolved in IS heavy ion spectra. The source regions of the hot heavy ion spectra are identified as energetic coronal events including flares and nonflare coronal mass ejections. DOE

N79-30127# Los Alamos Scientific Lab., N. Mex.
SOLAR WIND STREAM EVOLUTION
J. T. Gosling 1978 12 p refs Presented at the 4th Intern. Conf. on Solar wind, Burghausen, W. Germany, 28 Aug. 1978 (Contract W-7405-eng-36)
(LA-UR-78-3031; Conf-780890-4) Avail: NTIS HC A02/MF A01

Highlights of the recent progress in understanding the problem of high speed stream evolution with increasing heliocentric distance are reviewed. Crucial to this understanding are the measurements made in the inner solar system by Helios and the outer solar system by Pioneers 10 and 11. When coupled with observations at 1 AU these measurements allow a testing of current theoretical models of stream evolution. DOE

N79-30128# Technische Universitaet, Brunswick (West Germany). Inst. fuer Geophysik und Meteorologie.
OBLIQUE PROPAGATION OF WAVES IN HOT SOLAR WIND PLASMA Ph.D. Thesis [SCHRAEGAUSBRETTUNG VON WELLEN IN HEISSEN PLASMA DES SOLAREN WINDES]
Heinz Werner Rehn 1978 171 p refs In GERMAN
(GAMMA-33) Avail: NTIS HC A08/MF A01

The propagation of waves with arbitrary propagation angles with respect to the magnetic field was studied. Dispersion relations obtained by linearizing certain basic equations are given. Because of the magnetic field, the particles exhibit double Maxwellian distribution characteristics. The plasma consists mainly of electrons and protons. The effects of alpha particles and thermal electrons were also taken into consideration. Reasons are given why the plasma can be considered collision free. Some interplanetary plasma parameters are discussed and the Whang two fluid model presented. Comparisons are made with cold plasma. Damping and instabilities were also studied. Author (ESA)

93 SPACE RADIATION

Includes cosmic radiation and inner and outer earth's radiation belts.

For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

N79-30129 Michigan Univ., Ann Arbor.
A PHOTOIONIZATION MODEL ANALYSIS OF QSO

ULTRAVIOLET EMISSION LINES Ph.D. Thesis
James Martin Shuder 1979 97 p
Avail: Univ. Microfilms Order No. 7916815

The intensities of QSO ultraviolet emission lines were investigated with the aid of detailed photoionization model calculations. In an effort directed toward understanding recent observations, namely the low ratios of UV to optical emission lines, consideration was given to such processes as charge-exchange reactions between ions of charge +3 or greater and neutral hydrogen, collisional quenching of UV resonance lines, and attenuation by dust. Particular attention was paid to the behavior of C 4 lambda 1549. Dissert. Abstr.

N79-30130*# Stanford Univ., Calif. Inst. for Plasma Research.
IS THE GALACTIC CORONA PRODUCED BY GALACTIC FLARES?
P. A. Sturrock and Robert Stern Jul. 1979 18 p refs
(Contract NAS8-33012; Grants NGL-05-020-272; NGL-05-020-668; Contract N00014-75-C-0673)
(NASA-CR-158394; SUIPR-780) Avail: NTIS HC A02/MF A01 CSCL 03B

The effect of the differential rotation of the disk of the Galaxy on magnetic field which penetrates the disk is considered. The magnetic field will be progressively distorted from a potential (current-free) form and will at some stage become unstable. It is expected that an MHD instability, a resistive instability, or a combination of the two, will result in the release of the excess magnetic energy and that part of the released energy will be converted into heat. By estimating the energy release and the rate at which this process will occur and by assuming that this energy input is balanced by radiation, estimates were obtained of the parameters of the resulting plasma. It appears that this process alone can heat a galactic corona to temperatures of order 10 to the 6th power K. G.Y.

N79-30131# California Univ., Berkeley. Lawrence Berkeley Lab.
MEASUREMENT OF ANISOTROPY IN THE COSMIC BACKGROUND RADIATION ON A LARGE ANGULAR SCALE AT 33 GHz Ph.D. Thesis
M. V. Gorenstein Nov. 1978 117 p refs
(Contract W-7405-eng-48)
(LBL-7968) Avail: NTIS HC A06/MF A01

Results of a measurement of anisotropy in the 3 K cosmic background radiation on a large-angular-scale are presented. Observations were carried out with a dual-antenna microwave radiometer operating at 33 GHz (0.89 cm wavelength) flown on board a U-2 aircraft to 20-km altitude. In eleven flights, between December 1976 and May 1978, the radiometer measured differential intensity between pairs of directions distributed over most of the northern celestial hemisphere. The measurements show clear evidence of anisotropy that is readily interpreted as due to the motion of the earth relative to the sources of the radiation. DOE

N79-30132# Laboratorio di Ricerca e Technologia per lo Studio del Plasma nello Spazio, Frascati (Italy).
COSMIC RAY NM-64 NEUTRON MONITOR DATA 5
G. Villoresi, N. L. Zangrilli, M. Parisi, M. Storini, A. Felici, F. Re, and F. Signoretti Sep. 1978 35 p refs
(LPN-78-8) Avail: NTIS HC A03/MF A01

Pressure-corrected data from the Rome neutron monitor and barometric pressure data are given in tabular form for the year 1976 together with the graphs of the corrected intensity. Details on the devices employed, operational mode, and data handling are given. Author (ESA)

99 GENERAL

N79-30133# Office of Naval Research, London (England).
EUROPEAN SCIENTIFIC NOTES, VOLUME 33, NO. 3
Aubrey W. Pryce and Victoria S. Hewitson 31 Mar. 1979 54 p refs
(AD-A068613; ESN-33-3) Avail: NTIS HC A04/MF A01 CSCL 05/1

This is a monthly publication presenting brief articles concerning recent developments in European Scientific Research. It is hoped that these articles (which do not constitute part of the scientific literature) may prove of value to American scientists by disclosing interesting information well in advance of the usual scientific publications. The articles are written primarily by members of the staff of ONRL and occasionally articles are prepared by, or in cooperation with, members of the scientific staff of the United States Air Force's European Office of Aerospace Research and Development and the United States Army Research and Standardization Group. Articles are also contributed by visiting Stateside scientists. GRA

N79-30134# Air Force Academy, Colo.
AIR FORCE ACADEMY AERONAUTICS DIGEST, FALL 1978 Final Report
E. J. Jumper, M. M. Tower, and John P. Eaton Feb. 1979 157 p refs
(AD-A069044; USAFA-TR-79-1) Avail: NTIS HC A08/MF A01 CSCL 20/4

This digest covers unclassified research in aeronautics performed at the United States Air Force Academy during the six months ending 1 January 1979. This report includes individual technical papers in the specific areas of aerodynamics, fluid mechanics, experimental instrumentation, engineering education and thermodynamics and heat transfer. GRA

N79-30135# Army Test and Evaluation Command, Aberdeen Proving Ground, Md.
AIRDROP Final Report
5 Apr. 1979 49 p refs
(AD-A068709; TOP-7-2-509) Avail: NTIS HC A03/MF A01 CSCL 15/7

The report describes the engineering procedures required to evaluate the ability of materiel to withstand airdrop operations in accordance with design requirements. It includes automotive equipment (and components), weapons, inert ammunition, missile support equipment, electronic equipment, and various items of quartermaster materiel. Excluded are rockets, missiles, toxic, explosive, and hazardous items. GRA

N79-30136# Technische Hochschule, Darmstadt (West Germany).
THIRD PROGRESS REPORT RESEARCH FROM 1975 TO 1976 Annual Report, 1975/1976 [DRITTER FORSCHUNGSBERICHT 75/76]
Oct. 1977 486 p refs In GERMAN
Avail: NTIS HC A21/MF A01

A catalog of all research and development projects either continuing or having been completed during the period 1975 to 1976 at the Darmstadt Institute of Technology is given. A brief description of each program is provided along with its objectives and pertinent techniques employed. Author (ESA)

N79-30137# Ecole Nationale Superieure de Techniques Avancees, Paris (France).
SCIENTIFIC RESEARCH ACTIVITIES, 1977 Annual Report [RAPPORT D'ACTIVITE SUR LES RECHERCHES A L'ENSTA EN 1977]
1977 92 p In FRENCH
(AR-1977) Avail: NTIS HC A05/MF A01

Research in the fields of industrial chemistry, hydrothermodynamics, computer methods, structures and materials sciences, and optics carried out or in progress at the Ecole Nationale Superieure de Techniques Avancees (ENSTA) is reported. The various projects are briefly described and, where possible, results are given. The pedagogical activities of the ENSTA are also discussed. Author (ESA)

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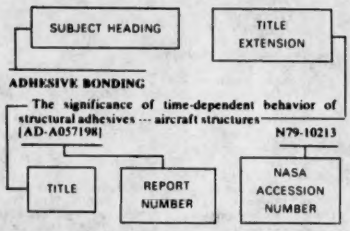

The subject heading is the key to the subject content of the document. Titles, report numbers, and accession numbers of pertinent documents are provided under each subject heading. When the title is insufficiently descriptive of the document content, a title extension has been added, separated from the title by three hyphens. The report number helps to indicate the type of document cited (e.g., NASA report, NASA translation, NASA contractor report). The NASA accession number is the number by which the document abstracts are arranged in this journal and by which the document is sold or requested. The titles, with title extensions if present, are arranged under each subject heading in ascending accession number order. The subject headings have been selected from the latest revision of the *NASA Thesaurus* (NASA SP-7050).

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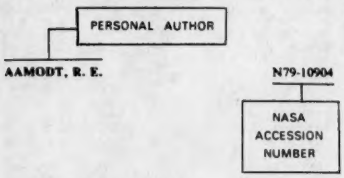

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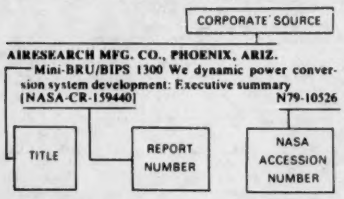

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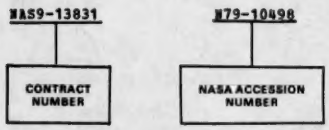

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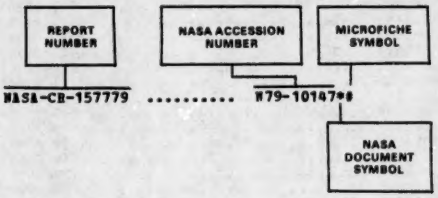

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